PUBLIC WORKS

CITY COUNTY STATE

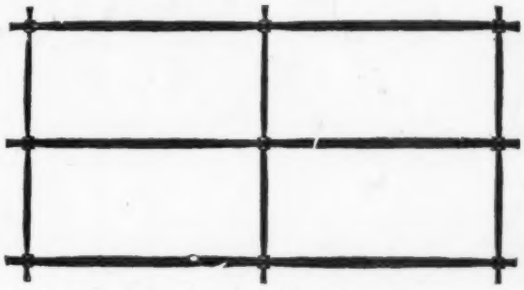
Engineering Library
JAN 17 1923

Right Reinforcement for Concrete Roads

The best way to build a concrete road is to use a combination of reinforcing steel and contraction joints. The ideal reinforcement is furnished in large flat sheets cut to length, ready for placing, and eliminating field labor and expense. The contraction joint provides a definite plane of weakness in the pavement, forming a straight regular crack for contraction and expansion. Used longitudinally it also marks the center line.

SOUTHFIELD ROAD, OAKLAND COUNTY, MICHIGAN.
Truscon Contraction Joints and Truscon Wire Mesh.
L. V. Belknap, Engr. R. D. Baker & Co., Contr.

Flat Sheets

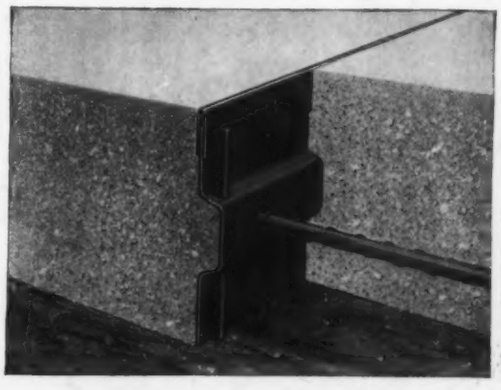


Truscon Wire Mesh

furnished in weights and areas as desired, in flat sheets cut to length. A sheet of many bars handled as a single unit, with rigidly connected joints so that the sheets stay true and flat in handling and after placing

Truscon Contraction Joints

16-gauge plate, rigid, substantial, easy to install. Removable cap is placed over contraction plate, keeping it a uniform distance below surface, and forming open joint, to be filled with bitumen or asphaltum. Vertical steel stakes hold plate rigidly. Holes are punched for tie rods.



TRUSCON STEEL CO. TRUSCON HIGHWAY PRODUCTS

Truscon Steel Company
YOUNGSTOWN, OHIO
Warehouses and Sales Offices in Principal Cities

"It Serves You Right"

THIS, our combined slogan and pledge to the thousands of users—past, present and prospective—of Austin-Western equipment, never meant as much as it does today. The Austin-Western line for 1923 is bigger and better than ever, while factory, office, warehouse and field forces have been organized with the one idea of rendering prompt, painstaking service to Austin-Western customers.

Our latest General Catalog, "Signs of Better Roads," illustrates and describes the old standbys of the Austin-Western line, and in addition many new developments of great interest and value to practical road builders, such as the Austin Double-Ender, the Austin Pup, the Austin Pressure Road Plane and the Austin Plain-tainer. We will gladly mail you a copy.

The
AUSTIN-WESTERN ROAD MACHINERY CO.
Factories and Home Office: Chicago
Branches and Service Stations in Twenty-two Cities
Visit our exhibit at the Fourteenth National Good Roads Show
Coliseum, Chicago, Jan. 15th-19th

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PUBLIC WORKS.

CITY COUNTY STATE

A Combination of "MUNICIPAL JOURNAL" and "CONTRACTING"

Vol. 54 January, 1923 No. 1

Two Links in the Lincoln Highway

Probably the most pretentious cross-continent highway proposition and the one which has come nearest to complete realization in this country is the Lincoln Highway. This aims to give a continuous route of well-paved roads extending from the Atlantic to the Pacific. However, it will be continuous as a route only and will consist of a number of links of varying physical characteristics and different degrees of perfection. It will cross mountains, plains and rivers and have a total length of about 3,300 miles, while it will vary in elevation from an altitude of 8,300 feet above sea level in Wyoming (between Cheyenne and Laramie) to nearly 100 feet below sea level in the crossing of the Hudson River.

Features of interest as well as scenic beauty are found all along the route. In the mountain wildness of the Sierras, the broad expanses of the plains and the busy thoroughfares of the cities through which it passes, will be found all kinds of conditions confronting road planners and road builders.

Two of the links of this highway that are at present of special interest are the "Ideal Section" in Indiana and the Hudson River tunnel between New York and New Jersey. Descriptions of these are given in this issue.

The "Ideal Section" of the Lincoln Highway

Several references to and descriptions of the "Ideal Section" have been given in PUBLIC WORKS during the past two years. The construction of the pavement proper has just been finished, but much remains before the section is fully completed. Early in the Spring the grading and surfacing of the shoulders, the landscaping of the right-of-way and the installation of the gravel pathway for pedestrians will be begun under the supervision of Jens Jensen, the landscape architect of the Lincoln Highway Association. At the same time the installation of the modern lighting system especially designed by the engineers of the General Electric Company (see PUBLIC WORKS for April 16th, 1921) will be undertaken, and it is expected that a camp site will be opened at some point along the Ideal Section and, following the completion of the section, that a memorial will be built to H. C. Ostermann, late field secretary to the Lincoln Highway Association, who was killed along the road in June, 1920.

While called the "Ideal Section," its designers

"IDEAL SECTION" OF LINCOLN HIGHWAY NEAR WEST END

ROUTE OF LINCOLN HIGHWAY FROM NEW YORK TO SAN FRANCISCO

do not claim it to be perfection, but rather as an object lesson of what is considered at the time to be the best practice in highway construction. Also, it is not assumed that every state or even any state can build all its roads after this as a pattern, since the cost would be prohibitive; but rather this is an ideal toward which they are expected to approximate as closely as conditions warrant.

This section lies between the towns of Dyer and Schererville in Lake County, Indiana, about 37 miles south of Chicago. It is 1½ miles long and has a right-of-way of 125 ft., only 100 ft. of which is being developed at present, but options on 12½ ft. additional on each side are secured to provide for utilitarian and esthetic development. The property required additional to that already publicly dedicated as a highway will be given to the State of Indiana by the Lincoln Highway Association. The road has been accepted by the Bureau of Highways as a federal aid road and aid will be granted at the rate of $20,000 per mile. The U. S. Rubber Company has contributed $120,000, the State of Indiana $49,500, and Lake County, Indiana, $25,000. The actual cost of the paving alone is given as $93,000.

The engineers of the "Ideal Section" are Lockwood, Greene & Company, and the contractor for the concrete paving was J. C. O'Connor & Sons. Jens Jensen is consulting landscape architect and W. G. Thompson consulting highway engineer for the association.

In deciding upon the details of the "Ideal Section," a technical committee was appointed by the association consisting of W. D. Uhler, A. R. Taylor, H. E. Breed, Clifford Older, T. R. Agg, F. R. White, A. N. Johnson, Edward R. Hines, Sidney D. Waldon, L. H. Wright, A. R. Hirst, A. H. Blanchard, J. M. Ritchie, W. G. Thompson and Elmer C. Jensen. This committee asked and received the advice of many other highway engineers and specialists, and received the cooperation of the General Electric Company in developing a lighting system, so that this section may be said to represent the composite opinion of the most prominent highway experts of the country.

Concrete was selected as the material, but with no intention to convey the idea that concrete is considered the ideal pavement—something that probably never will be attained. The width of the concrete pavement was decided upon as 40 ft., to provide four lanes of continuous travel. While it is recognized that, as Prof. A. M. Johnson has said, "highway plans contemplating an extended system of highway of greater width than is required for two lanes of traffic are extravagant and have no economic justification," human safety was considered to be even more important than purely economic considerations, and it was believed that this would be greatly advanced by the construction of a wider highway.

On each side of the concrete pavement there will be constructed five feet of earth shoulder, just outside of which will be a submerged drain pipe with catch basin at intervals. Concrete post for supporting the lighting units will be placed just outside of the shoulders. About 10 ft. from the edge of one shoulder will be constructed a five-foot sidewalk.

It was decided to design the pavement with a view to carrying 28,000 lbs. total gross load, a maximum gross load of 8,000 lbs. on each rear wheel, and a limit of 800 lbs. per inch of tire width. Although no theory was available for the exact calculation of a pavement to carry this

LINCOLN HIGHWAY CROSSING RIDGE BETWEEN CASCADE LAKE AND EMERALD BAY

load, a ten-inch slab was arbitrarily decided upon, on a sub-base crowned parallel to the roadway surface, of concrete mixed 1-2-3. Reinforcing metal was used at the rate of about 80 pounds per hundred square feet placed three inches below the top of the slab. The concrete pavement was built in two sections, a longitudinal joint being placed in the center of the roadway. Three-quarter-inch steel bars five feet long were placed across this longitudinal joint three feet apart to hold the two sections at a uniform surface. The cross-section is parabolic with a total crown of 2½ inches.

The drains, as stated, are buried, open drainage ditches being considered unsafe. Four-inch drain tile is buried about three feet below the surface in a trench 18 inches wide, which is filled around and above the tile with gravel with a few inches of earth at the top.

The lights will be mounted on concrete poles 35 feet high and spaced 250 feet between centers staggered on opposite sides of the roadway. Lamps will be 2,500 lumens, mazda C, 6.6 amperes. Current will be transmitted through a steel armored cable buried about 12 inches in the ground.

As stated above, the shoulders, sidewalk, lighting system, etc., have not yet been installed, but the concrete road itself has been completed and will repay an inspection. It is readily accessible from Chicago, and the association hopes that many of the engineers and highway experts attending the Good Roads Congress will inspect the work so far completed during their attendance at the convention.

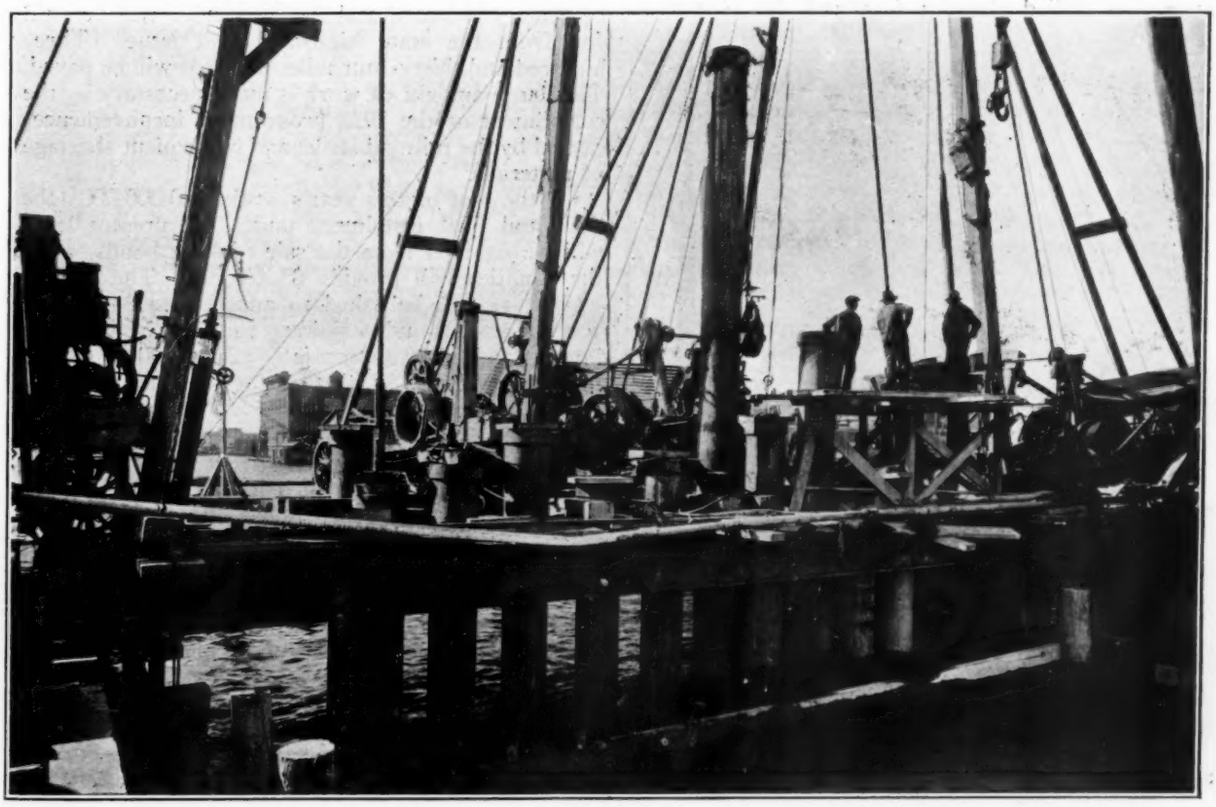
Hudson River Vehicular Tunnel

A difficult foundation of great depth formed by hollow steel piles driven 250 feet to penetration in solid rock.

The vehicular tunnel under the Hudson river from Canal street, New York, to Jersey City, consists of two 29½-foot concrete-lined cast-iron tubes about 40 feet apart on centers, each having a single two-line one-way traffic roadway and a narrow footpath at an approximate depth of 93 feet below mean high water. They will have an estimated yearly capacity for 15,000,000 vehicles, and for this maximum service provision will be made to change the air forty times per hour, thus eliminating danger from the poisonous gases produced by the motor cars. A fresh air supply of 3,600,000 cubic feet per minute will be required.

To circulate such an immense volume of air through the tunnel, there will be installed a large mechanical equipment and two pairs of ventilating shafts, 3,375 feet apart, just within the pierhead lines. At the foot of each of these shafts there will be rigid connections to the tunnels on the land and river sides.

On the west side of the river the shafts and tunnels will be located in mud and silt, which is not considered reliable for sustaining very heavy loads without settlement. It was therefore decided to support each of the shafts on a foundation consist-



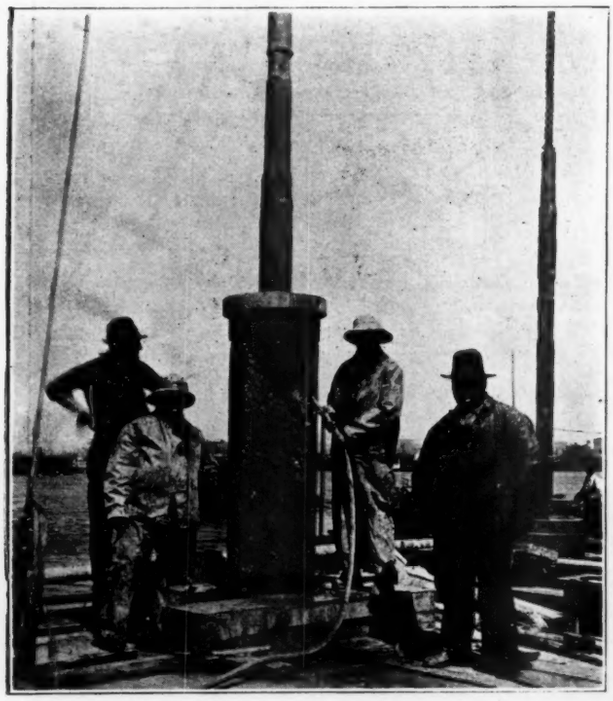
DRILLING PLATFORM AND OIL WELL MACHINES FOR SINKING 24-INCH FOUNDATION PILES

ing of forty-two 24-inch steel and concrete piles driven to penetration in the solid rock about 250 feet below mean high tide. The construction of one of these pile foundations ready to receive the ventilating shaft, which will weigh about 15,000,000 pounds exclusive of the portion of the tunnel weight it carries, has been successfully accomplished by a modification of methods and equipment developed for sinking oil wells.

Permanence and stability that eliminate serious danger from otherwise possible unequal settlement have thus been quickly and economically secured by simple standard methods and an important advance in foundation work has been attained which will be of special value in supplementing the possibilities of the foundations in soft materials that have hitherto been chiefly constructed by the sometimes uncertain open dredging method, or the costly pneumatic caisson method which is strictly limited to depths corresponding with the maximum safe pressures in working chambers (about 50 pounds above atmospheric).

A temporary working platform having been constructed at the site of the shaft, steel pipes, 24 inches in diameter and 20 feet long, weighing about 3,100 pounds each, were delivered there and three pieces assembled together by outside screwed sleeves to form a 60-foot section. These were successively centered, plumbed with accuracy in their required locations, and driven at the rate of about 2½ feet per hour by the combined effects of their own weight, the operation inside of a heavy drilling bit, impact from a hammer, and frequent bailing with a long cylindrical bucket.

As the pipe descended, additional lengths were screwed on top, and when it finally reached rock the latter was drilled about a foot and the pipe was driven down to the bottom of the hole to give it good bearing and lateral stability.



3,000-LB. OIL WELL BIT FOR SINKING 24-IN. STEEL PILE

After the driving had been completed, the pipe was cleaned out, assembled reinforcement placed in it and the pipe filled with concrete up to the cutoff level. The upper part of the pipe, from 100 to 110 feet long, was cut off by a tool suspended in the pipe and operated from the working platform. When the cutoff portion of the pipe, which penetrated 60 feet or more through the mud and silt, adhered too firmly to the latter to be pulled by the derricks available, it was easily loosened and quickly brought to the surface by means of air forced into it at a pressure of about 100 pounds per square inch.

The footings for each of the two shafts on the west side of the river will be built in steel pneumatic caissons floated to position and sunk through the pipe driving platform until their cutting edges reach an elevation slightly below the cutoffs of the foundation piles, which will eventually be imbedded in the concrete deposited in the working chambers of the caissons and forming the bottoms of the ventilating shafts.

The work is being done under the direction of the New York and New Jersey State Bridge and Tunnel Commissions, Clifford M. Holland, chief engineer. Booth & Flinn are the general contractors and Sprague & Henwood are contractors for the pile foundations.

Michigan Highway Work

It is announced by Frank F. Rogers, state highway commissioner of Michigan, that the Highway Department has planned an expenditure of $16,253,194 for 1923, which will be used in the improvement of 978 miles of road, of which 490 miles will be federal aid road and the remainder will be paid for from the state highway bond issue. Three hundred and thirty-four miles of roads will be paved. This large amount of work is made necessary by the curtailment of the 1922 program by inconveniences caused by the railroad strike and consequent shortage of materials.

Of the cost of this year's work, $10,000,000 (the fifth and final instalment under the present law) will be obtained from the sale of state bonds, while the counties will provide $3,273,791. The coming legislature will be asked to appropriate $4,000,000 for interest on and a sinking fund for retiring the bonds, and also appropriate $2,000,000 for road maintenance and $2,500,000 for state aid on non-trunk line roads.

Refuse Incinerator Bids

On December 18th the City of Allentown received bids for a refuse incinerator having a capacity of 70 tons in 24 hours, to be constructed on foundations and in a building, both of which, together with the chimney, are to be furnished by the city. Four bids were received complying with the specifications, which called for a steam boiler and provision for creating power to be used in pumping sewage, the bidders being the Balmer Corporation, $49,500; Bartlett & Snow, $57,760; Hiller Engineering Company, $62,900, and the Universal Destructor Company, $70,000.

New and Improved Contractors' Appliances

The following information concerning contractors' appliances has been furnished to us by the manufacturers in response to a general inquiry made for a description of machinery, tools, etc., that were introduced by them during the year 1922, or important improvements made in machinery already on the market. Readers will therefore understand that no attempt is made in this article to list all the available machinery—which in fact would have been impossible within the limits of this magazine. We have however done our best to obtain information concerning all new appliances designed for use by contractors, especially those engaged in highway work.

Earth Handling Machinery

AUSTIN-WESTERN ROAD MACHINERY COMPANY

This company gives as its 1922 contribution to road machinery the Austin "Pup," Pressure Road Plane, and Double-Ender.

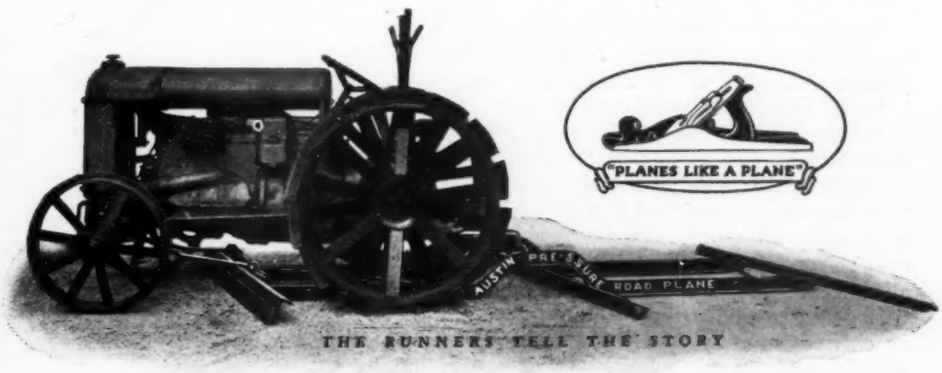
The Austin Pup was described in our December issue. It consists of a small, three-wheel road roller weighing only three tons. It was developed for preparing subgrade, but can also be used for rolling gravel, stone or earth roads, or drives in parks or cemeteries, or for pulling a wheel or drag scraper. It is built with the Fordson tractor as the propeling basis. The total length is 12 ft. 6 in., width, 5 ft., weight on rear rolls, 4,120 lbs., and on front rolls, 1,880 lbs.

The Austin Double-Ender consists of extensions provided for every size of the regular line of Austin graders, to be attached to each end of the blade, permitting three feet to be added to one or both ends at any time and removed when not needed. The peculiar feature of the Austin extension is that when not needed it is not removed but is merely swung back behind the blade and does not interfere with any operation of the machine. In addition to this, the extensions can be set at an angle with the blade and make of the blade a wheel scraper holding from one to two yards of earth for filling in hollows. They are furnished as extra equipment with new graders or can be attached easily to old ones by drilling a few holes in the blade.

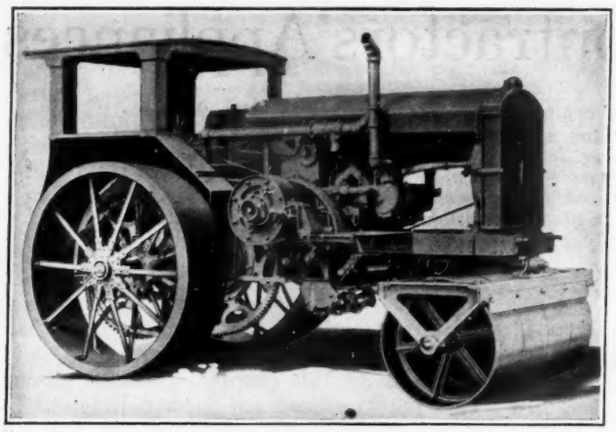
The Austin Pressure Road Plane is made to be attached to a Fordson tractor and is believed to differ in two important respects from other road planes or levelers. One is that the cutting edge is carried on the front of a pair of long runners, corresponding to the base of a carpenter's plane, which runners prevent the planing blade from cutting into any but the high spots. A fixed blade following behind fills the low spots with the material cut off, while a third loose blade levels off the road. Another feature that is believed to be unique is that part of the weight of the tractor is transferred to the runners of the plane, the operator being able to increase or decrease the amount of pressure at will. It is also possible to work one end of the cutting blade lower than the other. The whole outfit is very compact and turns in a short radius. The pressure plane consists primarily of a pair of ten-foot runners attached beneath the tractor and extending several feet behind it, to which are fastened in front the planing blade, behind this the packing blade, and in the rear the leveler. Two levers with special pressure rods are used to raise or lower either side independently of the other and transfer the weight of the tractor to the plane. While traveling from place to place the entire attachment is raised off the ground. It is claimed that, with the aid of the weight of the tractor this plane will take off the high spots in the hardest and dryest of roads. On the other hand, by removing the pressure it can be used on soft or sandy roads. The use of the Fordson tractor carries with it the advantage of ability to secure repair parts, which are carried by all Fordson dealers. The planing blade is seven feet six inches long, as are also the packing blade and leveler. The entire plane weighs 550 pounds.

NEW AVERY ROAD ROLLER

The improved Avery 25-50 road roller has a roller of extra heavy diameter so as to roll readily over high piles of loose dirt that are thrown up by the grader. The front roller is also more than sufficiently wide to overlap the rear wheels and is mounted on a large turntable revolving on one-inch steel balls. The rear wheels are furnished either with the regular steel rim, or extra heavy with cast rims. When equipped in



AUSTIN PRESSURE ROAD PLANE



AVERY GAS OIL ROLLER

the latter way, this makes an ideal 10-ton roller.

The roller has the same motor and exclusive features as are found in the regular Avery tractors of similar size. The 1923 model has a new improved cooling and oiling equipment, including cellular radiator, water pump and fan and several other refinements. The chief advantage claimed for this equipment is that, when building a dirt or gravel road, by rolling and packing it from the subsoil to the top surface at the same time the grading is done, there results a smooth surface which is immediately available for traffic, does not soften easily with rain nor rut with the wheels of passing vehicles.

BEACH MANUFACTURING COMPANY

A dragline bucket for removing marl from marl beds was put out last year by the Beach Manufacturing Company, which company also perfected an arrangement whereby three wheel scrapers of special design can be hitched behind a Cletrac or a Fordson. One man can load the three wheel scrapers in succession more easily than he can a horse-drawn scraper. The wheelers are adjusted to track each other so that the three and the tractor can turn in a circle of 16 to 21 feet.

The company has also built a new gravel screen plant which it says works on an entirely new principle, and which is small enough to be shipped in one end of a common box car, but has a capacity of about 300 cubic yards a day.

GOOD ROADS MACHINERY CO.

This company last year brought out three new machines—the "Winner Highway Patrol" road grader, "Champion" pressure oil distributor, and "No. 16 Champion" steel rock crusher.

Road Grader. The Winner Highway Patrol is described by the maker as "a simple, sturdy, convenient and serviceable patrol machine." It is operated by one man and two horses. Almost entirely of steel with all parts interchangeable. Wheels concave; front, 22 in. diameter, rear, 30 in. Hubs of all wheels fitted with dust-proof grease cups. Blade, 6 ft. long, can be reversed or adjusted to any angle, or shifted laterally two feet outside the line of the wheels, and its tilt adapted to any soil, having a range of 25 degrees.

LEE TRUCK BODIES

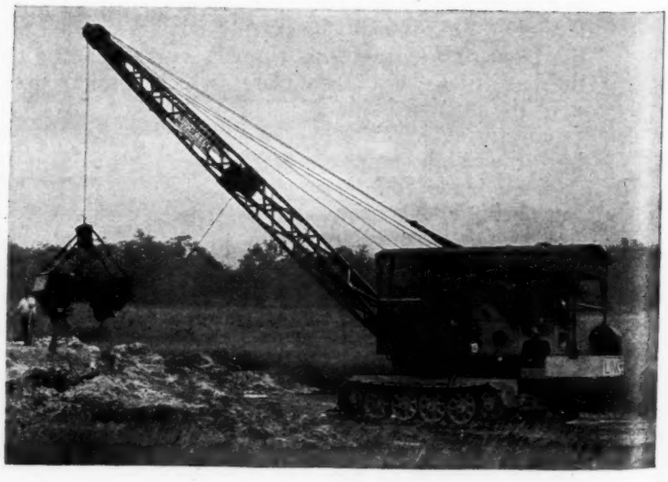
The Lee Trailer and Body Company about a year ago brought out its Lee 4-D and B Bodies. The 4-D can be used with a Ford truck. When so used, the loading edge is 4 ft. 4 in. from the ground, believed to be the lowest dump truck body on the market. The standard size is one cubic yard level full, but for materials lighter than sand, asphalt, etc., the capacity can be increased by adding side boards. By pulling one handle the body rolls over and dumps automatically, the end gate opening automatically, and the body returning automatically when empty. The dumping angle is 45 degrees. Despite the lowness of the body, there is 14 inches ground clearance when dumping. Special bodies are made for light material, such as street sweepings; also a steel watertight body for garbage.

LINK BELT CRAWLER TYPE CRANE

The Link-Belt Company will exhibit at the Road Show, in its space in the balcony at the right of the main entrance, in addition to its portable loader and belt conveyor, a new crawler-type crane which was first put on the market in 1922.

This crane can operate with hookblock, grab bucket, dragline bucket, skimmer bucket, steam shovel attachment, electric lifting magnet, wood grapple or pile driver attachment. It can lift 10 tons at 12 feet radius or 3 tons at 30 feet radius. The boom is 35 feet long. It can make four complete revolutions per minute, travel three-quarters of a mile per hour and easily climb a twenty per cent. grade. One man can operate the entire machine.

The first of these cranes to be put in operation was used in low, swampy ground, removing the muck over-burden, digging sand and building subgrade for a road between Gary and Michigan City. In spite of overloading and unskilled handling, it excavated and placed on the road in about 2½ months, over 30,000 cubic yards of material. On conclusion of this work it was placed on a flat car in twenty-five minutes, moving by its own power up a temporary incline, part of which had a thirty-five per cent. grade. It then was used at a sand pit, where it loaded forty-yard gondola cars in less



LINK-BELT CRAWLER TYPE CRANE IN ACTION

than twenty minutes, using a ¾-yard grab bucket. Owing to the self-cleaning construction of the tread, the machine has never been stalled in either sand or muck.

ORTON & STEINBRENNER CRANES

Several improvements were made last year in the crawling tread cranes of Orton & Steinbrenner Co. In addition to the auxiliary steam shovel dipper the company has developed a reeved type of dipper shovel especially applicable to its gasoline and electrically driven machines. Also a skimmer scoop attachment has been added, which can be suspended from the regular crane boom without detaching it and which is used for tearing up old pavement. A new steering gear is being used with these machines which permits the crane to be turned at any time while traveling, loaded, irrespective of the relative positions of the boom and car body. Also improvements have been made strengthening the grab bucket and to other features of the apparatus.

P. & H. HOISTS AND EXCAVATORS

The following summary is sent us by Pawling & Harnischfeger Co. of improvements and additions made in their products during 1922:

"1—We brought out a complete line of electrical, gas and belt driven contractors' hoists and elevator hoists.

"2—The No. 206 '8 in 1' machine, which may be converted into shovel, skimmer, dragline, clamshell, pile driver, backfiller, or crane, had numerous improvements made. Among these are the worm-driven self-locking boom hoist, twin disk engine clutch, and improved cast steel corduroy frame, and an improvement was also made in the shovel, so that it may be converted from the standard machine into a shovel by means of adding one shaft. The crowding motion is provided with larger brake surface on the drums. The skimmer scoop was also improved so that the bucket runs out beyond the edge of the skimmer boom, making it ideal for basement work. A steel cab arrangement was also perfected which can be supplied, and the pile driver was also improved. The sheaves were all made of larger diameter so as to lengthen the life of the cables. The fair-lead was also improved to give maximum cable life.

"3—There was also brought out for general sale the No. 208 machine. This type of machine has been used for some time by the U. S. Reclamation Service for dragline work, but is now being built as a 1 yd. shovel, skimmer scoop, clamshell, pile driver, crane, etc., the same as the 206 machine. Other improvements were made on different machines."

STOCKLAND ROAD MACHINERY CO.

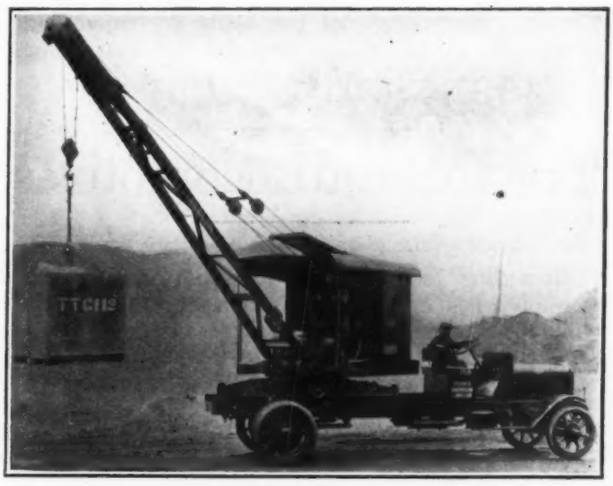
The Stockland "Master Quicklift" was put on the market in 1922 as a combined maintenance grader and light construction grader. For the former work it can be drawn by four horses, for construction grading by six horses, or a 15 h.p. tractor. With a single pull on a lever the blade is raised instantly when necessary, as for manhole covers, crossings, etc., and then returns to its exact former adjustment.

The blade is regularly 7¼ ft., or may be 6, 8 or 10 ft. if desired. The wheelbase is unusually long—10 ft. 11 in. The blade lifts 9 in. above the ground and has a lateral shift of 20 in. and pitch adjustment of 3 in. The tires are 4x5/16 in. and the tread 45 in. front wheels and 77 in. rear.

Other additions during the year were a back-sloper attachment for large blade graders, and a 3-horse dump wagon hitch; also improved wheel and Fresno scrapers and bottom-dump wagons.

UNIVERSAL CRANES

The cranes now furnished by the Universal Crane Co. were first brought out about three years ago, but were first used for road work in 1922. In that year an improvement was made on the boom operating mechanism so that the lowering is controlled mechanically to positively prevent the boom from dropping without resorting to the slow worm gear drives. It is mounted on a motor truck and can travel from job to job at motor truck speed, or on a trailer or continuous tread if preferred. It swings in a full circle; has 4 to 5 tons capacity. Gasoline engine. The crane unit, without mounting, weighs approximately 12,500 pounds.

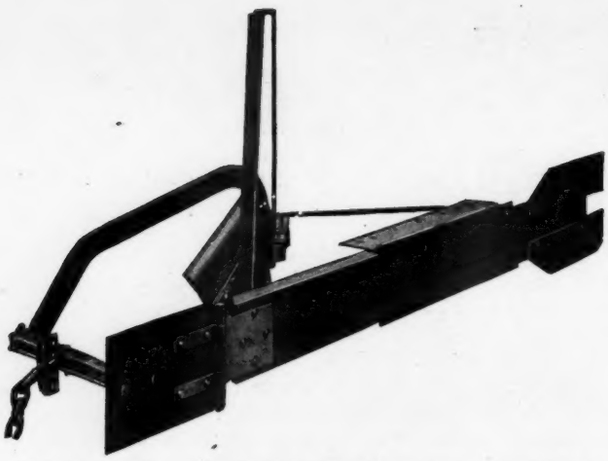


UNIVERSAL CRANE MOUNTED ON GARY 5-TON CHASSIS

Road Builders' Truck, 1923 model. This was designed by the Western Wheeled Scraper Co. to provide the increased capacity batch box that road builders are now using. The end construction is reinforced, center sills used, size of axles, bearings and springs increased. The journal box is supplied with a manganese split bushing and all loads are carried on the the center line of bearing.

Scarifier. A new type of scarifier can be attached to the company's Standard Little Western and Aurora graders, the scarifier rotating and being raised and lowered with the blade and always remaining parallel with it. By having the scarifier project about two inches below the blade it loosens the gravel or stone and cuts down bumps so that the blade may level them easily. When not in use the scarifier can be raised.

Westford Grader. A combination of the Little Western grader and the Fordson tractor, operating as a single unit. For reversing direction, the tractor can be turned independently.



BACKSLOPER AND DITCHER WITH GUIDE RUNNER ON LANDSIDE

Western Back-sloper and Ditcher. For smoothing off banks, ditches and highway cuts. Can be operated on a one-to-one slope, and for any height by using it after each successive four-foot cut. Can also be used for cutting or cleaning lateral ditches. Both edges of the blade are fitted with detachable shares, easily removed for sharpening. Steel fins that polish quickly carry all side draft.

See also Lakewood subgrader

Tractors and Locomotives

BROOKVILLE GASOLINE LOCOMOTIVES

Providing locomotive attachments to the Ford one-ton truck and the Fordson tractor, the Brookville Truck and Tractor Co. enables contractors who have these to adapt them to use for haulage on construction track, and to obtain all the advantages of Ford power, including ready replacing of parts in any part of the country. The Ford or Fordson is used intact, except for the removing of such unnecessary parts as wheels and steering apparatus, and can be returned to its original condition as truck or tractor with a few hours' work.

The company has been building the locomotive parts for the one-ton Ford for four years, but having received many requests for heavier haulage, it placed on the market in the summer of 1922 the Fordson attachments. More speed than the Fordson tractor gave was believed to be necessary, particularly in reverse, where the Fordson is limited to about 2 miles per hour. The Fordson locomotive has a speed of 6 miles both forward and reverse, and a low of 3 miles forward. The high speed in reverse eliminates the need for a turntable or Y at either terminal of the track, as the locomotive can run in reverse in the direction furnishing least resistance.

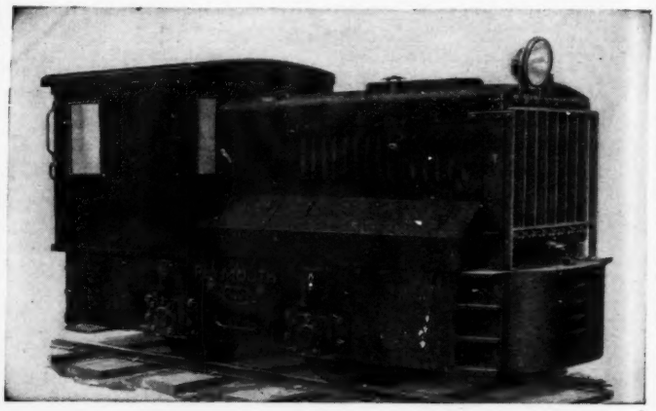
The Fordson unit is a three-ton, four-wheel drive locomotive, especially suitable for highway construction work. If, in a later job, track haulage is not desirable, it can again be changed to a tractor in a few hours. The manufacturer furnishes either the attachments alone, or the locomotive complete, and for all gauges from 24-in. to 4 ft. 8½ in.

The four drive wheels are each 20 inches in diameter, with steel face. Wheel base, 36½ inches (adapted to sharp curves). Frame, heavy ship channel. Journal boxes, railroad type. Brake shoes on all four wheels, controlled from driver's seat. Weight, 6,000 lbs., or as much more as is desired and paid for.

FATE-ROOT-HEATH LOCOMOTIVE

A 7-ton, 4-speed, gear drive gasoline locomotive has just been put on the market by the Fate-Root-Heath Co., which the manufacturers claims has developed by test a drawbar pull of 5,250 pounds on a sanded rail. It has four speeds, 2½, 4, 8 and 12 miles per hour, forward or reverse.

This excellent result is said to be due to the design and construction of the transmission. The gears are unusually large, an exclusive feature being an additional shaft and final driving gear 14½-inch diameter by 4-inch face, no jackshaft being required. The gears that are driven are the only ones in mesh. All gears are of alloy hardened steel. All bearings are inside gear case. The final drive is by means of two short, heavy chains, one to each axle, driven direct from the transmission.



PLYMOUTH 7-TON, 4-SPEED, GEAR DRIVE GASOLINE LOCOMOTIVE

The power is a Buda heavy-duty, 4-cylinder engine, with Bosch high tension magneto and Bosch starter and lighting. The clutch is dry plate type with nine driving discs. Lever brake rigging produces equal brake pressure on all four wheels. The frame is of massive construction and close to the track.

Bitumen Heaters

LITTLEFORD HEATER

A small tar and asphalt heater, especially adaptable to patrol work in road maintenance, was placed on the market in 1922 by Littleford Brothers. The heater can be handled by one man. The capacity of the kettle is 25 gallons. A convenient drain is provided at the rear where the valve is kept warm, because of its close proximity to the fire box.

The large fire box is fitted with renewable cast iron grates and the furnace shell is protected by liners of fire box steel. The rectangular kettle is removable. The seams are heavily welded, thus

eliminating all possibility of leaks and possible danger of fire. A removable cover is provided. The heater is mounted on two all steel wheels 18 inches in diameter with 2-inch by ⅜-inch flat tires. The axle is 1½ inches in diameter. A handle, well braced and fitted with stiff-leg, is attached to front end at a convenient height for drawing the heater about. This heater is known as the Midget No. 69.

THE MACLEOD COMPANY

This company gives as its new products a combination gravel dryer and tar heater; a tool heater that will heat 12 tools at one time, and a 30-gallon tar kettle, all made to use fuel oil only. Also oil burners for heating kettles, an oil tank outfit for several mastic kettles or a large tar or asphalt heater.

CHAMPION OIL DISTRIBUTOR

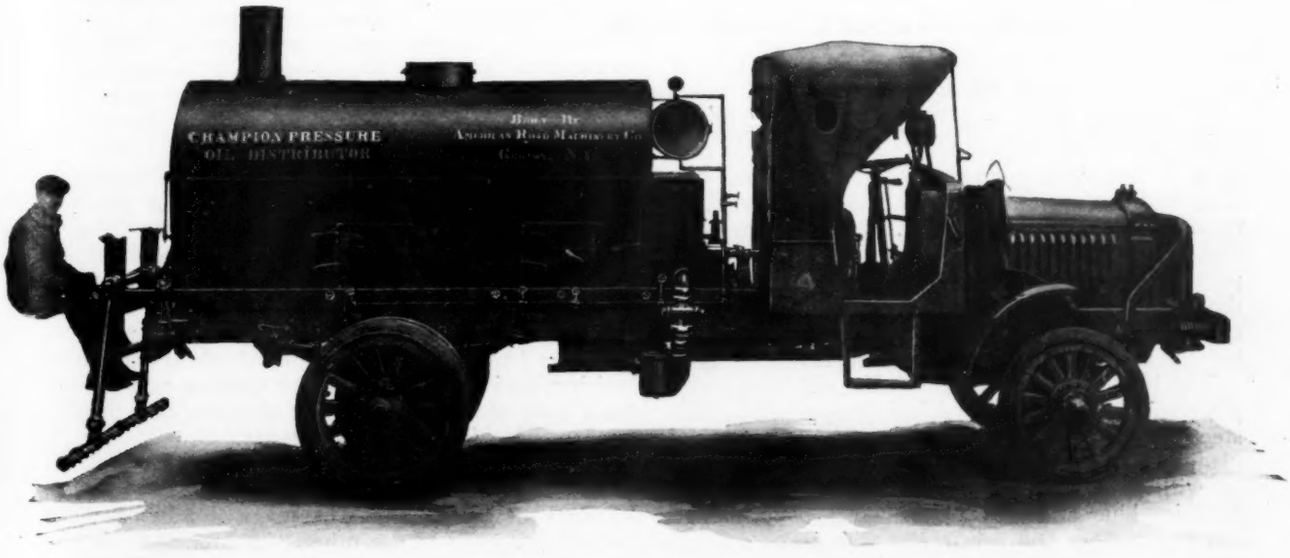
Oil Distributor. The Champion Pressure Heating Distributor consists of an encased tank, a battery of burners, a series of pipes, a distributing manifold, and a pump which is driven by a power take-off shaft of the motor transmission and is located directly in the discharge line from the tank. The unit has been used as a horse-drawn appliance for many years, but is now made as a complete detachable unit that may be removed from the chassis at will, permitting the latter to be used for other purposes. The mounting of the unit on the chassis is a shop operation, and the chassis should be sent to the company's factory, equipped with power take-off and clutch where these are available. This distributor will handle all kinds of road oils. It is claimed that the speed of trucks and size of distributing nozzles can be varied to regulate the rate of oil distribution from ½ to 2 or more gallons per square yard of roadway. The tanks are made of 600 gal., 800 gal. and 1,000 gal. capacity, for which 3½ ton, 5 ton and 7½ ton trucks, respectively, are best adapted. This is manufactured by the Good Roads Machinery Co.

THE LITTLEFORD HEATER

Concrete Machinery

AMERICAN CEMENT MACHINE CO.

Although concrete mixers were originally drawn attached to horse-drawn rigs, nearly all are now moved about the job or from job to job hitched behind a truck and, on account of their small steel wheels, not only do these and the axles give out when drawn at a fifteen to twenty-mile speed, but the hard jolting and rattling soon works the bolts loose, the parts go out of alignment, battery and engine parts are injured and breakdowns and delays result. It has been found by the American Cement Machine Co. that by using not less than 30-inch wheels with pneumatic tires, all the noise and rattling is eliminated and the harm that it is claimed



GOOD ROADS CO. "CHAMPION" PRESSURE OIL DISTRIBUTOR

the small steel wheels do to pavements is prevented, and such rubber-tired equipment is now being furnished by that company. "Boss" one-bag highway mixers are being furnished with 4-wheeled trucks equipped all around with cord tires, while the handy size Packard tilting mixers are placed on 2-wheel Ford trailer trucks. The extra cost is believed to be more than compensated by the saving in lost time due to delays formerly experienced. While the mixers are in operation, blocks can be used under the axles, thus taking all strain off the tires. As Ford standard tires are used, they can be replaced readily and at low cost.

RUBBER TIRES ON A CONCRETE MIXER

BLAW-KNOX COMPANY

In addition to its new Batcherplant and Turntable, which were widely sold last season, this company is introducing an entirely new cement handling and loading device which has just been placed upon the market and which, the company says, "will eliminate all laborers handling cement at the paver and will also embrace a device for loading the cement quickly into the trucks with an absolute minimum of labor. This will also permit the successful use of bulk cement if desired."

The 1923 road form, type C. K., will have a one-piece stake strap and a stiffening plate of 3/16-in. steel plate. The Dreadnaught type of form is planned for use where the heaviest form is needed to withstand unusual conditions. It is made of 3/16-in. blue annealed O. H. steel plate, flanged top and bottom and reinforced with three specially designed heavy stiffening plates and stake straps.

BOAZ CONCRETE MIXERS

A concrete mixer along the same lines as the machine formerly built by the New Way Mfg. Co. is now being turned out by the Boaz Mfg. Co., which, however, has made some radical improvements in the drive system whereby it claims to reduce to a minimum the wear from sand, gravel and cement and the consequent cost of upkeep. The loading hopper is lowered from 5 to 7 inches.

The company aims to conform its entire line of mixers to the demand of the average contractor for low initial cost and low upkeep; also light weight to avoid slow, expensive moving, but with sturdy construction throughout. Above all, to provide speedy and thorough mixing and discharge.

The company has also completed the designing of a small mixer to mix 3 cu. ft. of wet material. It is of the horizontal drum type, the same as its larger machines, and is gear driven. It weighs about 1,200 lbs. and can be very easily handled by a few men. It can be rolled on a small truck and together with a few men and wheelbarrows can be quickly and cheaply moved to distant jobs. It is a low-priced and easily handled machine, but is claimed to be sturdy in construction and to mix real concrete with remarkable speed.

GALION BATCH MEASURING HOPPER

This hopper, for quickly and accurately measuring any exact quantity of crushed stone, sand or gravel from bin to truck or wagon, was described in our December issue. It can be installed on any unloader or screening plant. It is manufactured by the Galion Iron Works & Manufacturing Co.

GEORGE HAISS MFG. CO.

The additions made in 1922 by this company consist of a "path digging" bucket loader elevator to be mounted on a motor truck chassis, and wagon loaders and portable belt conveyors mounted on Fordson tractors. They have also made improvements on their "creeper loader" and "path digging" loader, increasing them in weight and strength of almost all parts, and adding a hand wheel and worm raising device for the elevator element and a tight cast iron gear case enclosing clutches and driving transmission for the creeper loader.

CHAMPION ROCK CRUSHER

Rock Crusher. The Champion No. 16 has been added this year to the other "Champions." It has 16x36 jaw opening, and with jaws set to close to 2

inches will crush 50 to 60 tons per hour, using 40 to 50 horsepower. The machine weighs 36,000 pounds. The first "Champion" crusher was manufactured thiryt-one years ago. The Good Roads Machinery Company is the manufacturer.

LAKEWOOD ENGINEERING COMPANY

This company will make several improvements in its 1923 machines. The road finishing machine will have a strikeoff adjustable so that it will operate as much as four inches below the side of the top forms, enabling the contractor to strike off the concrete for placing reinforcement or for two-course concrete. The universal joints on the drive shaft and other parts have been strengthened and several minor changes made.

A new Lakewood unit is a steel frame subgrader, which is equipped with scarifying teeth to assist in breaking up the subgrade ahead of the machine. Another new item is the grade-rooter, or light scarifier, the purpose of which is to lightly scarify the subgrade prior to the use of the mechanical subgrader.

A new type of road form, known as the "Carr Form," is made with a rounded top which prevents any stones or concrete from possibly getting under the wheels of subgrader or finisher. The form has a 5-inch base, not complicated by any stake pockets, the stakes being driven anywhere so as to grip the outside edge of the base of the form. A simple wedge arrangement locks the sections of forms together, securing an even, unbroken line for the top of the forms. The sections are made 12 feet long of 3/16-inch metal, the increased length meaning fewer joints and fewer pieces to be handled.

An improvement in Lakewood track has been made by designing the curves and switches to a 60-foot radius. The batch box cars are equipped with either cage-roller or Hyatt bearings. The cement compartments of the batch boxes are now equipped with a chain diagonally across the bottom of the compartment, which aids materially in the discharge of the cement when the box is dumped, the chain falling through the cement and breaking down any arching effect that might tend to hold it in the box. The boxes are of steel with capacities of 24, 29 and 37 cubic feet, with an adjustable trunion which can be varied so as to insure easy tipping of the box for any size batch.

The 21-E Paver is a new item in this company's equipment. It is furnished with a 4-cylinder Wisconsin motor on full multiple plane traction and is built especially heavy to stand hard service. All bushings are of bronze and replaceable.

MARSH-CAPRON COMPANY

This company, besides having greatly improved its three-quarter yard M. C. Rail Track Mixer, especially for use in central mixing plants, introduced in 1922 an entirely new machine called the Universal Junior, a half-bag machine used by road builders on culvert and curb work. It has a full-size charging platform 3x4 ft. and only 19 in. off the ground; a friction clutch, and is operated by a 3 h. p. Novo engine. It has capacity of 4 cu. ft. of mixed concrete. The drum, 36-in. diameter, makes 16½ r. p. m.

HOTCHKISS ROAD FORM

The M.-C. Hotchkiss road forms, which have been on the market for several years, will in 1923 have a 5-inch base instead of 4-inch, to provide greater bearing surface; heavier joint lock rivets and stay pockets, and a novelty at the ends of the form called "saddle plates," which are said to absolutely prevent sagging of the joint.

ROUGHIN PAVING GAUGE

An adjustable paving gauge propelled by one man is furnished by the Roughin Adjustable Paving Gauge Company. This gauge is made with adjustable crown and can be lowered any desired distance below the curb or track on which the end runners travel. For template, instead of the customary flat steel, the manufacturers have substituted a shoe that is almost half round and securely fastened and shaped to the parabola of the desired crown, which tends to compress the subgrade, cushion, concrete, etc. The weight of the gauge and operator, about a thousand pounds, is utilized in this compression. One man, standing on the gauge at the center and operating two crank handles, moves the gauge forward or backward, under high or low gear. By means of a lever the operator can raise the entire gauge from ¼-inch to 1-inch above the established grade.

CAREY TONGUE AND GROOVE EXPANSION JOINT.

A new form of "Elastite" joint manufactured by the Philip Carey Co. was described in the December issue.

General

DOMESTIC AIR COMPRESSOR

The "Domestic" Air Compressor, first placed on the market in 1922 by the Domestic Engine and Pump Company, is claimed to differ in several ways from any previous compressor. One important characteristic is that two cylinders of the gasoline engine are used for each cylinder of the compressor and the power impulse of the engine piston is directly transferred to the compressor piston. While the engine is horizontal, the compressor is vertical, thus permitting the use of the first half of the power stroke of the engine directly for compression, while the last half of the stroke with its low pressure per square inch supplies sufficient momentum to the flywheels to scavenger the engine cylinder of burnt gas.

Another point emphasized is that, while new and fresh oil is supplied only to the engine and compressor cylinders, a partial vacuum is created in the crankcase of engine and compressor, drawing this oil backward from the cylinders

and preventing the danger of explosions in the air receiver tank by excess oil poured into it.

The No. 50 machine has two engine cylinders and one air cylinder; speed, 610 r.p.m.; displacement, 50 cubic feet per minute. No. 100 has four engine cylinders and two air cylinders, and is practically two number fifties combined. They are mounted on a 2-horse truck with 24-inch steel wheels, and have a steel cab enclosing engine and compressor. No. 50 has a net weight of 2,500 lbs., and No. 100 a weight of 4,500 lbs.

The company also manufactures a Domestic Double-Acting Force Trench Pump combining large capacity and minimum bulk and weight, which will handle water found in sewers or trenches. Being double-acting, it has maximum capacity for its bulk. Being a force pump, it will discharge to higher levels or through long horizontal pipe or hose. It can be equipped with a winch head which is capable of giving a single line pull of 300 to 500 lbs., which can be used for lowering or lifting materials in trenches or manholes, drawing cables through conduits, etc. This pump is made with capacities of 5,000 to 6,000 gallons per hour against 40 to 80 feet vertical elevation. The suction and discharge pipes are both three inches. Instead of rubber or leather diaphragm, this pump has a plain cylindrical plunger packed with ordinary water plunger packing. In addition to the gasoline operated pump, the company furnishes an electric driven pump of the same capacities.

EVINRUDE HIGH-PRESSURE PUMP

This pump was considered to be in a stage of experiment until last August, but since then a number have been put into service with results that exceeded anticipation. This pump has a length of 31 inches, width of 11½ inches and height of 7½ inches and weighs only 99½ pounds, but can deliver 1,500 gallons of water per hour through 1⅓ miles of 1½-inch pipe or against a head of 277 ft. It thus can supply water for boilers and for concrete mixing on road work extending for 2⅔ miles, from a water supply in the middle of the section.

EVINRUDE 2 H.P. CENTRIFUGAL PUMP COMPLETE

The pump is of gear type, connected to the power plant by an Oldham coupling. The engine is the well-known Evinrude 4-5 h.p. 2-cylinder. The gasoline tank has a capacity of 1⅓ gallons. The motor runs 2¼ hours on one gallon of gasoline. The suction and discharge are each 1½ inch with standard pipe thread. All parts are standard and are carried in stock at all times by factory and distributors.

In addition to the high-pressure pump, the Evinrude Motor Company makes a centrifugal pump which has been improved lately and is claimed to make an excellent contractor's pump, remarkable for its portability, high capacity and low cost. The pump weighs 115 pounds and can be moved readily by one or two men. It is used for pumping out wet trenches or other excavations, for lifting water into tanks for sprinkling carts or other uses. It can be lowered into and supported in an excavation by a sling and rope, or can be carried by two men by means of a pair of handles. The pumps are made in two sizes, one capable of lifting 6,150 gallons per hour against a 10-foot head and the other 8,400 gallons.

EASY PIPE PUSHER

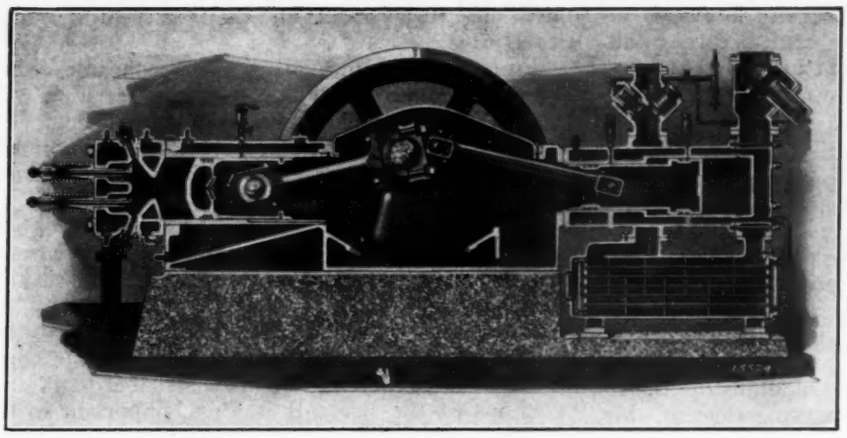
During the past year the Easy Mfg. Co. has perfected a pilot for use in pushing pipe through ground. Water under city pressure can be forced through this pilot, which washes some soils, softens others and lubricates so that the pipe can be pushed easily and accurately through soils that were before impossible. This pilot has worked successfully in sand and gravel soils and even where stones opposed its progress. Pipe from ¾ inch to 12 inches diameter has been pushed for 100 feet or more with this jack and pilot.

DIRECT-INJECTION OIL ENGINES

The Ingersoll-Rand Company has recently put on the market a horizontal direct-injection oil engine which is used for a number of purposes, among these being the operation of air compressors and ammonia compressors. The engine employs the Price system of fuel injection which eliminates the need for a three-stage or four-stage 1,000-lb. pressure injection air compressor with intercoolers.

The air injection Diesel engine has long been regarded as the most economic and efficient prime mover. The Price oil engine is to all intents and purposes a Diesel engine, but with the air compressor eliminated, which results in a saving of ten to twelve per cent. in mechanical efficiency. It is claimed that .38 or .39 lb. of fuel per brake horsepower can be easily attained, the former figure meaning 20 h.p.-hours from a gallon of standard fuel. The makers also guarantee that the engine will deliver 4,000 h.p.-hours per gallon of lubricating oil, every possible mechanical precaution being taken to prevent the waste of oil. The engine operates on a 4-stroke cycle and the exhaust and intake valves are actuated by push rods from cams. The cams are housed in a compartment case in the engine frame, which protects them from injury and permits keeping them flooded with lubricating oil.

The company has lost no time in putting on the market one of these engines direct connected to an air compressor. This unit consists of a 100 h.p. engine with the air cylinder in line with the power cylinder but on the opposite side of the crankshaft. For 100 lbs. pressure a two-stage air cylinder is offered. The air intercooler is mounted below the air cylinder and forms a support for it. For air



INGERSOLL-RAND AIR COMPRESSOR

pressure less than 100 lbs. a single-stage cylinder is offered. For both single and two-stage work the air cylinder is double-acting. In the 50 h.p. size the air cylinder is vertical and is mounted on top of the engine immediately above the crankshaft. This construction makes it possible to mount the unit on a flat car or truck for use in portable work. The total height, however, is less than 8½ feet. The Price engine has also been direct connected to an ammonia compressor unit, of which two sizes are now being made, the larger having an actual delivered capacity of gas equivalent to 63 tons of refrigeration and the smaller having half this capacity. The manufacturers claim that, even allowing for greater firstcost, air can be compressed with fuel oil at 6c. per gallon on a par with electric power at 1¼c. per k.w.h., while with fuel at 12c. a gallon the equivalent cost of electric power is 1½c.

Official Conclusions From the Bates Road

Which may, in the opinion of Clifford Older, chief engineer of the Illinois Division of Highways, be safely drawn from this test.

Clifford Older, chief highway engineer of the Illinois Division of Highways, presented to the American Association of State Highway Officials, at its annual meeting in December, an official statement of the conclusions that "may safely be drawn from the general behavior of the Bates Road." The two outstanding conclusions he gives as: "First, the load-carrying capacity of any design of rigid pavement slab is in direct proportion to the ability of its weakest part to resist bending stresses."

Second: "Rigid pavements having a uniform thickness or edges thinner than the center are greatly unbalanced in strength and will fail along the edges long before wheel loads are reached that would cause the destruction of other portions of the slab."

Commenting upon the first, he said that under fixed conditions pavements of definite thickness will carry certain wheel loads indefinitely, but a considerable number of somewhat heavier loads will result in numerous corner breaks, while still heavier loads may quickly result in complete destruction. It follows that pavements cannot be constructed that will not be utterly destroyed in a few months or years if the wheel loads are not rigidly controlled. This control must be had by a state police force, and only such a force can prevent the early destruction of any road that it is practicable to construct.

Commenting upon the second conclusion, Mr. Older stated that "although fifty of the original sixty-three sections of the Bates Road were either partially or completely destroyed, not one case of serious partial or complete destruction of a rigid section occurred that was not directly due to the lengthening and widening of one or more small broken corner areas. . . . There is much evidence to support the belief that had all of the traffic been not closer than three feet to either edge, even the 4-inch slabs would still be intact. Increasing the edge strength of pavements of ordinary width should, therefore, be of first importance in design."

Concerning the effect of richness of mix, he states that two mixes were used, both with practically the same ratio of sand to stone, but one with half as much cement as sand and the other with one-third as much. "While most of the engineers, who were in constant touch with the test during its progress, believe they can trace a showing in favor of the rich mix, yet the difference is by no means marked." He concludes that "leaner mixes with increased thickness to compensate for strength loss may be an economic development under certain conditions."

He then discussed the results as classified by types of pavement. Concerning brick wearing surface with bituminous joint filler on waterbound macadam base, the destruction of this type consisted of rutting in the wheel tracks until the sections were unfit for traffic. In the case of asphaltic concrete on waterbound macadam base, there seemed to be "no consistent relation between load-carrying capacity and thickness of base" or of top. He stated that "practically all visitors agree that the soil and subgrade condition was as nearly uniform as ever occurs."

Mr. Older then discussed the data obtained from this test in its bearing on the assumption that the corners of rigid pavements or bases should be designed as unsupported cantilevers. Incidentally he stated that "the assumption made, when the test sections were originally laid out, that the bituminous-top pavements would have a strength equal to the strength of the base if the same were increased by one inch is only partially borne out. . . . It would appear that an allowance equal to one-

quarter of the top thickness is fully as much as would be justified." However, critical corner failures in such pavements were not in many cases followed by immediate breaking-down of large areas as in some other rigid types.

In December, 1920, Mr. Older suggested a tentative formula for pavement design based on the assumption that the corners of slabs should be designed as unsupported cantilevers. This theory was used as a basis for studying the results of the Bates tests, the formula for slabs of ordinary design being

$$W = \frac{Sd^2}{3}$$

W equals $\frac{Sd^2}{3}$, in which W is the breaking load, d is the depth of slab and S the modulus of rupture of the concrete or other load-carrying element. Mr. Older plotted points having the breaking load as ordinates, and the base thickness as abscissas, on the basis of this formula he plotted curves using values of S to fit most approximately each class of pavement. The curves fitted to these several cases gave values of S of 706 for Topeka top on concrete base; 631 for monolithic brick assuming the pavement acted as two concrete layers having the thickness of the base and the top respectively; 726 for all concrete sections, and 733 with the omission of those sections containing calcium chloride and cemite cement, which had distinctly lower modulus of rupture than the other sections. In the results for the remaining concrete sections, which included plain concrete, those containing wire mesh and one containing hydrated lime, the actual and theoretical loads showed a surprising conformity.

In general, Mr. Older concludes that the test, using the load which caused the first corner breaking as a basis, corresponded very closely to the theoretical breaking load on the cantilever basis. An apparent exception was the monolithic brick pavements if the assumption was made that the total thickness of the pavement acted as a unit. It was observed that at many points the brick surface separated distinctly from the base, and it was noted that at many critical points the base and the brick top acted as independent units.

The fatigue tests which have been carried on by this department for about eighteen months "indicate conclusively that concrete may resist bending loads indefinitely if such loads do not cause fibre stresses in excess of one-half of the modulus of rupture of the concrete. Inasmuch as it was impossible to operate the trucks a sufficient number of trips for each increment to cause fatigue, the plotted points in all diagrams without doubt are but little affected by fatigue breakage. The laboratory tests show that where the loads applied, produced a fibre stress of from 5 to 10 per cent. in excess of one-half of the modulus of rupture, fatigue may not follow for from 5,000 to 40,000 repetitions. Loads which produce fibre stresses in excess of 60 per cent. of the modulus of rupture are usually followed by breakage after a comparatively few repetitions.

"It seems safe, therefore, to conclude that had the number of applications of each increment been much greater—say 30,000 to 40,000—we would have the breaking load points falling, in the main, between the curve passing through points representing a fibre stress of 703 and that representing a fibre stress of 351."

From these results Mr. Older concludes that, while the theory on which the above formula was based "is, perhaps, not yet fully established, nevertheless, the empirical data furnished by the traffic tests seem to be sufficiently confirmatory to justify its use at least until something better is found."

"By means of one or more continuous dowel bars along the edge, it is believed that adjacent corners may be made to act together and thus the breaking and working loads may be increased materially, or, perhaps, even doubled. Further, it is easily conceivable that if in addition to dowel bars the edges are thickened, they may be made stronger than other portions of the slab. It is, then, important to determine where next to look for trouble; and eventually determine how the slab should be designed for balanced strength throughout."

The behavior of the test section shows that loads much in excess of the critical load, as determined by the theoretical curve, are almost sure quickly to cause extremely serious progressive destruction.

It would seem difficult to eliminate the danger entirely. It is suggested that shoulders of gravel, macadam, concrete or other material which could be constantly maintained, preferably slightly higher than the permanent edge, would help. Such shoulders would ordinarily prevent wheel loads from being applied to the extreme edges of the slab and thus tend to reduce bending stresses. Center traffic lines also help because where such lines exist drivers concern themselves only with keeping their vehicles on the proper side of the line. Without such lines they crowd to the outer edge of the pavement in order to make sure to clear passing vehicles.

Heavy triangular corner repairs or rigid material will also help, as the obtuse angled corners of the adjacent old slab will carry greater loads than right-angled corners.

Limiting the loads to the strength of the slab would solve the problem for the old pavement.

Designs for new pavements should undoubtedly provide for strengthened edges.

This may be accomplished by providing integral curbs which would not only strengthen the edge but largely prevent wheel loads from being applied to the extreme edge. It is believed that wider pavements with integral or inverted curbs, using no more or even less material than is now used in many designs, would afford equal or possibly greater load carrying capacity.

Merely increasing the width would undoubtedly prolong the life by reducing the frequency of the passing of heavy wheel loads off and on, and along the edges.

Longitudinal joints in concrete pavements reduce the warping due to changes of temperature, thus increasing the possibility of subgrade support along the edges under night traffic. Such joints should be provided with tie bars to prevent spreading, and a corrugated or tongue and groove effect, so that the adjacent slabs would afford mutual support.

Mr. Older then described the new Illinois design with the thickened edge, which has already been described twice in "Public Works." Four sections of this type have been added to the Bates Road, and will be tested by truck traffic early next spring.

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Labor and Immigration

Unless the three per cent Immigration Law is radically changed, construction and manufacturing in this country must, it would seem, suffer a serious setback and wages increase beyond reason. Some restriction on immigration is probably desirable, but this law seems to us to provide few desirable restrictions and many undesirable ones. For example, last year only 42,000 Italian immigrants were allowed to enter the country, but 53,000 left it, causing an actual decrease of 11,000 in a class of immigrants upon whom the East relies largely for its labor.

A beneficial law should provide for making up such deficits in any given nationality or, better still, in any class or type of labor in which a shortage may temporarily be found to exist. Moreover, all concerned would be benefited if the weeding-out be made at the ports of embarkation instead of in this country. The burden of proof should be placed on the immigrant to show that he is desirable for our needs, for immigration to this country is a privilege, not a right. Physical, moral and political tests should be prescribed, and applied to each would-be immigrant by competent United States officials in the several foreign countries or points of assemblage for embarkation.

Labor depletion under this law has already begun to produce its effects, and will become a serious matter when we get into full swing—or endeavor to —in our efforts to make up for lost time in public works, railroad work and other lines of construction that were interrupted by the war.

The National Association of Manufacturers a few days ago announced a program of immigration legislation to be presented to Congress, which contractors and others interested in public works might well endorse. The Association advocates fixing a quota in terms of net immigration, authorizing the Secretary of Labor to use his judgment in admitting beyond the quota if shortage of any class of labor be shown, eliminating the literacy test, more stringent requirements for naturalization, exercising the right of registering, distributing and educating the aliens meantime, and that all features of immigration regulation be controlled through a board composed of the Secretaries of Agriculture, Commerce and Labor. The need for some changes in the law certainly seems to be imperative.

Unfortunate Limitation of Borrowing Power

An opinion rendered by the City Solicitor of Philadelphia has not only produced a decided shock among the administrators of that city, but the general principle involved is, in our opinion, a most unfortunate one to impose upon any city. In brief, this is that the total cost of a complete municipal improvement which has as yet been undertaken in part only becomes immediately a charge against the borrowing capacity of the city, even though a large part of the expenditure may not be made for many years to come. It is of course very desirable that restraint be placed upon city officials to prevent their committing the city to extravagant expenditures, and the law placing a limit upon the amount of

money that can be borrowed by city bonds is a wise one. As a matter of fact, if the state laws themselves did not place such a limit, one would be placed by the financiers in refusing to take a city's bonds after they had reached a certain total. This is indicated by the fact that, although the New Jersey State laws assign a higher percentage of a city's assessed valuation as its bond limit than do the laws of New York State, some New Jersey municipalities find it wise to confine their indebtedness within the New York rather than the New Jersey limits because they wish to float their bonds in the former state, through New York City bankers.

This, however, is an entirely different matter from including, in the issues so limited, bonds that may not be required until ten or twenty years hence to complete a project which is only being begun in the present. We fear that the effect of the general adoption of such a ruling would be to return the cities to the condition of years ago when public work was done piecemeal rather than as parts of a comprehensive plan prepared to secure systematic construction extending over as long a period as might be necessary to complete the entire program. City planning and all that is involved in it might be seriously interfered with. For instance, it has been stated that the constructing of any of the several sewage treatment plants proposed for Philadelphia will be held up until the city's finances reach the point where they will permit providing, within the bond limit, of a sufficient sum to finance *all* of the plants which it is proposed to build during the next ten to twenty years.

There certainly can be found some middle course between this ruling and extravagance which will sufficiently safeguard the taxpayers and the investors in the city's bonds, without compelling a return to the unco-ordinated construction of public works which was unfortunately the practice a generation ago.

The Bates Road Tests

Comments on the Bates road tests conducted by the Illinois Bureau of Highways, as expressed by Will P. Blair, vice-president of the National Paving Brick Manufacturers Association, have recently been made public. In his comments, after describing the various sections of the road and the tests made, Mr. Blair discusses various features of the test and draws the conclusion that "with all the official information before us respecting the Bates road experiment and the light gained from actual observation, we do insist that with so many factors left out of consideration, there is little that can be relied upon as a guide to a preferential road construction."

His chief reason for this conclusion appears to be that, while the promoters of the road assumed that it was placed on a uniform condition of soil and every effort made to secure uniformity throughout, no such uniformity actually existed. In some places water oozing from the sub-soil beneath the road deposited a film of sand in the bottom of side ditches, while at other points no sand was in evidence whatever and it was believed that no sand was present. As to water content, the official observers reported that the supply of moisture in the subgrade varied intermittently from zero to forty per cent. In some places the subsoil was so saturated that the vibration of the pavement under traffic could readily be witnessed by the eye, water even being thrown from the edge of the pavement with considerable force by the traffic.

Day by day in every way it became evident that no two sections of the entire two miles of pavement were alike in bearing power of the soil. This being the case, it could not be claimed, Mr. Blair maintains, that any result of any one section of withstanding or failure to withstand the traffic imposed formed any criterion for comparing the durability or other value of that section as compared with the others.

As further evidence of this, the official reports themselves point to certain inconsistencies, which would naturally be expected from this non-uniformity of sub-base. For instance, the official statement contains the words: "No consistent ratio of strength to thickness of base appears," since a 6-inch base at one point did not become badly damaged until after the fourth increment, while an 8-inch base yielded under the second increment. Mr. Blair remarks: "Other inconsistencies are mentioned in sufficient numbers to entirely break down the values observed as consistent." In fact, it appears to him that phenomena classed as consistencies on the assumption of a uniform sub-base really need more explanation than do those classed as inconsistencies.

Moving Construction Track Bodily

In building a 12-mile section of concrete pavement last year (which, by the way, he accomplished with a single mixer) C. M. Kirkpatrick of Greenfield, Indiana, introduced at least one novel method. This was the moving bodily of a 300-foot section of 24-inch gauge track whenever the mixer was moved, this being the track over which the aggregate was brought to the mixer.

An interurban railroad paralleled the pavement and the cement, sand and pebbles used for the concrete were delivered by this, the cement being unloaded from cars directly to wooden platforms and the aggregates being brought in 12-yd. side-dump cars and dumped alongside the railway. After being dumped, the aggregates were distributed by means of a scraper to form a continuous winrow or stock pile parallel to the track. The 300-foot 24-inch gauge track referred to was laid paralleling the interurban railway, located near the center of the subgrade and just ahead of the mixer. Two Barber-Greene portable bucket loaders were used for loading sand and pebbles into motor trucks mounted on flanged wheels which traveled on this track and dumped directly into the mixer hopper. Each of these motor trucks carried a wooden box with a hinged door at the back, the bottom of the hopper sloping downward toward the rear. A short hinged

section of track extended over the edge of the skip to permit dumping directly into the skip, and folded back when the skip was raised.

The track was mounted on continuous wooden supports under each rail and made up of a 1x6-inch strip underneath a 2x6-inch. Whenever the mixer was moved ahead, the entire section of track was pulled forward the same distance by means of a cable and two capstans which were rented from a house-mover, each capstan being operated by a horse. The cable passed through a pulley fastened to the track and each end of the cable was attached to a capstan. By using the two capstans the moving was done in half the time that would be required with one only. At first a 500-ft. section of track was used, but this was reduced to 300 feet.

The mixer was a Koehring 21-E paver. A Lakewood tamper carried on heavy Heltzel forms was used in finishing. The pavement was covered with burlap and wet straw was placed on top of this to protect the concrete during the curing period.

During July the contractor averaged 600 feet of pavement 18 ft. wide and 7-8-7 inches thick, with a maximum day's run of 743 ft. in 10 hours. It is believed that this was the record for Indiana for the year 1922.

Concrete Road Finishing Machines

By G. Maxon, Jr.

The past year has seen considerable advance in labor-saving devices for striking off and compacting concrete. In discussing the subject, it is probably best to divide the field into two, if not three classes.

Jobs where the concrete is mixed wet and the aggregate contains considerable excess mortar are thought of as unfavorable to the use of a machine. This sort of concrete can be handled without the aid of a machine and excessive tamping tends to raise too great a quantity of mortar to the surface, and consequently water-holes appear after the initial set. Wherever mixes of this sort are preferred, it is very essential that but little tamping should be done, and a transverse roller be used to remove the excess moisture and to eliminate water-holes. It is expedient, if a machine is used, to have one on this kind of work that strikes off with extreme accuracy. There are two machines now on the market which have the strike-off working directly on the rail and which have the required degree of accuracy. One of these machines at the present time is too heavy for ordinary road-forms, but the quality of work it does with a wet mix and where there is an excess of mortar cannot be improved upon. We suggest that, where the strike-off alone is used, considerable spading be done inside the forms, otherwise the road will be porous along the sides.

Mediumly dry mixes, particularly where no great amount of excess mortar is provided, must be compacted by tamping. It is most essential that concrete of this sort be free from voids, in order to realize the greater possible strength of such a mixture than that of a wet mix. The other essential feature in producing the best possible quality of road with this type of mix is accurate striking off. If the machine used does not strike off accurately, considerable skill and experience on the part of the spreaders in producing an even surface is necessary.

Very dry concrete requires repeated tamping and considerable retouching, regardless of the machine used. It is most desirable that if a machine be used that has an accurate strike-off, that member be used together with the tamper whenever the machine is moving forward. If this striking member has a smooth bottom, it can bring the surface to crown and elevation with two or three applications, but if the strike-board has a knife-edge, it will tear up the concrete which has been partially put in place by the tamper.

A machine experimented with last year places the concrete by means of a roller. This roller is supposed to strike off and compact the concrete. With wet mixes the hydrostatic head of the concrete in front of the roller will cause it to bulge up in the rear. With dry mixes, this roller, which rotates in the opposite direction to which it is traveling, will tear out the larger aggregate and leave no end of voids, particularly where the road-slab is thin. It is a well known fact to those who have finished concrete in any shape, that in troweling, but little weight can be used on the concrete before it has reached its initial set, and this roller trowels and applies weight.

Devices which propose to eliminate tamping may be practical where the concrete is quite wet, but there can be no question as to the necessity of tamping in very dry mixes. It is the only practical means of completely eliminating voids and should always be done until both the air and the excess water are brought to the surface for removal.

Machines for placing concrete roads should have a certain amount of excess power and the very best of material should be used, for the reason that their weight is limited and the strains and vibrations on a machine which spans the entire road and strikes off concrete are greater than one might imagine. The contractor should be very careful not to choose a machine that has too much weight. There is no road form made at the present time that will stand up any length of time with a load of more than twelve hundred pounds on any one wheel. The front wheels of all machines approach this limit, and there are a few machines where practically eighty per cent. of the weight is carried on the front journals and which ultimately destroy the rail.

Other features to be considered are the accessibility of parts, ease of operation and speed. Referring to this latter consideration, there are places where two finishing machines are required. If there is not already on the market a machine that can handle twelve or fourteen hundred lineal feet of concrete road in a day, one should be developed.

Considering machines in general, every job of five miles or more should be finished by machine. Whatever the nature of mix, a machine is obtainable which, when properly operated, can produce a better surface and a better road than the most skilled hand-work, and do the same with a distinct saving to the contractor, particularly where four hundred feet or more is laid within one working day.

Recent Developments in Sewage Treatment

Review of development of skimming tanks, fine screens, Imhoff tanks, separate sludge digestion, continuous sludge removal, contact beds, activated sludge, and the Maclachlan process.

In a paper with the above title read before the American Society for Municipal Improvements, George W. Fuller summed up briefly some of the recent developments and newer systems.

Skimming tanks. Under this head he referred to the Toledo plant where the skimming tank now under construction will receive sewage after it has passed through cage screens, the sewage so entering the tank as to have a circulatory movement which causes an eddying effect so that the floating materials will rise to the surface, allowing grease to become attached to corks and other solid matters which will be skimmed from the surface from time to time. This device, he says, is closely similar to the skimming tank at Washington, D. C., which has been so successful in eliminating floating matters from the submerged outlets in the Potomac river.

Fine screening. Fine screens have been recommended at Los Angeles and additional ones for sewers discharging into New York Harbor. Probably the largest are those to be used in connection with activated sludge plants at Milwaukee, Indianapolis and Chicago. The Riensch-Wurl screen has now as competitors less expensive ones such as the Dorr, installed at New Britain, Connecticut, and Bethlehem, Pa.; the Link Belt screen at Pleasantville, New Jersey, and the Rex screen developed at Milwaukee by the Chain Belt Company; while the last-named company is building a drum screen at Indianapolis designed by Mr. Hurd.

The screenings at the Dyckman Street plant in New York are barged to sea by the Street Cleaning Department; at Rochester they are dumped and covered with material removed from the grit chamber; at New Britain they are hauled to an isolated site and dumped; at Plainfield, N. J., they are at once plowed into the land, and at Long Beach, Calif., they were burned in an oil-fed incinerator.

Imhoff or two-story tanks. During the past ten years the tendency has been to make the flowing-through compartments smaller and the sludge storage compartments and sludge beds larger than formerly. The flowing-through compartment is ordinarily made from seventy to ninety feet long with linear velocities not exceeding 1.5 to 2 feet per minute. The vents should occupy about 20% of the total area of the tanks. It is not safe to figure on less than 90% of water in the sludge in the lower compartment, and it has frequently reached 93% to 96% at Plainfield, N. J., and York, Pa. Designs were formerly based on about 85% water content, for which reason the capacity of this compartment should be 50% to 100% larger than in earlier designs. In the northern states the sludge storage should be on a per capita basis of 1.7 to 2 cubic feet per capita. In the extreme northern part of the country it may be desirable to increase this by 50%, while in southern climates it may be reduced somewhat. The area of sludge beds, instead of being one-third square foot per capita, should, Mr. Fuller believes, be at least three-quarters of a square foot in the northern states, and one square foot where combined sewers are used.

Separate sludge digestion tanks. Under this head the author gave briefly information concerning the Baltimore tanks which were described at some length in Public Works for August.

Somewhat similar is the use of single-story tanks such as septic tanks in rotation. At Plainfield and Morristown, N. J., and Washington, Pa., the plan was tried of allowing sewage to flow through one tank until the effluent contained objectionable quantities of suspended matter; then putting this tank out of service and using a second tank, and then a third tank; the first tank meantime being allowed to stand and the sludge digest. The results were fairly satisfactory in each case until the tanks became overtaxed. He believes that such tanks should be built in five or more compartments with a total capacity of eighteen to twenty-four hours of average sewage flow.

Continuous sludge removal. At Syracuse, N. Y., extensive tests have been made with sedimentation tanks arranged with scrapers working along the bottom of the tanks from the outlet toward the inlet end. It was found that the velocity of flow should not exceed about 1.75 feet per minute and that the detention period need not be more than about three-quarters of an hour. About 60 per cent. of the suspended matter was removed under these conditions and comparatively little increase was obtained by a longer detention period or lower velocity. Continuous removal of the sludge prevents the formation of gas and of gas-lifted floating sludge. Floating matters are retained by scum boards. Solids removed from the floor of the tank by the scrapers will be mixed with wastes from the Solvay Process Company.

At Indianapolis "concentrate thickener tanks" have been designed, there being four, each fifteen feet wide at the top and about 120 feet long. The floors of these tanks will be scraped by scrapers moving from the outlet toward the inlet at a speed of not more than five feet per minute. These tanks will receive the solids rejected by the screens and their effluent may be sent to the river or pumped to the influent of the aerated tanks of the activated sludge process. The sludge from the thickener tanks will be mixed with the settled sludge coming from the activated sludge process and the resulting mixture dewatered.

Contact beds and trickling filters. Ordinarily contact beds are not so economical as trickling filters, but have a distinct field of usefulness for some small plants, in that they do not call for so great isolation as trickling filters, because they do not disseminate odors by spraying, nor are they subject to the fly nuisance. They also require a smaller head than is needed for sprinkling filters. There is some advantage in the use of these followed by sand filters where a high degree of purification is desired.

Trickling filters have probably been more successful in bringing about a practical accomplishment of what was originally expected of them than any other single group of sewage treatment devices. Such filters have been in use twelve or more years in this country and twenty to twenty-five years in England without needing cleaning. The three points given special attention are odor, plant loading, and control of flies. Odors are generally caused by the spraying of septic sewage, whether from septic tanks or sewage which has become stale in sewers. Nozzle clogging seems to be more or less inevitable. Even where the sewage as it reaches the filter contains no suspended matter, there will be intermittent detachment of accumulations of fine suspended particles that adhere to the inside of the distribution system. However, fine screens can keep this within reasonable control.

With ordinary six-foot beds, a rate of 2,000,000 gallons per acre per day is by no means excessive. Non-putrecible effluent may be obtained at rates 20% in excess of this, especially if the beds be made somewhat deeper and if the nozzle spacing and heads be such as to secure more uniform distribution over the surface than is found in a number of plants. In some southern climates filter loadings up to 3,000,000 gallons per acre have been found feasible.

These figures refer to sewage that has been settled. If the sewage is only passed through fine screens, the rate will be considerably less.

Concerning flies, Mr. Fuller stated that these are found in the upper layers of most but not all trickling filters and described the method of preventing them by drowning the larvae and pupae by flooding the filters at intervals of ten days, as has been described in Public Works.

Activated sludge process. Operating experiences show that this process can turn out regularly a clear, non-putrescible effluent from which 90% to 98% of the bacteria in the raw sewage have been eliminated. Questions as to the practicability of the process relate to economies of sludge handling and to the cost of construction and operation.

With the drop in the value of fertilizer there seems little chance of selling sludge for this purpose and present efforts should be devoted to minimizing the cost of sludge handling. At Houston activated sludge is delivered from settling tanks into lagoons and allowed to accumulate there year after year without producing a nuisance. For the north side of Chicago, Messrs. Eddy, Hatton and Fuller recommended delivering activated sludge without dewatering through a pipe line to waste lands between the Desplaines river levee and the main drainage channel, until such time as a drying operation has been perfected, the cost of which will not exceed the proceeds to be derived from the sale of the sludge as fertilizer. Possibilities for sludge-lagooning are of course not always to be found. In fact, at the north-side plant in Houston difficulty in finding land for the purpose has led the city to consider various means of dewatering the sludge.

The Maclachlan process was described by Mr. Fuller and the plant at Gastonia (see PUBLIC WORKS for March 4th). In the plant at Houston the sludge is passed through a cylindrical inward-flow drum screen covered with sixty-mesh brass wire cloth revolving about two-thirds submerged in a vat through which sludge treated by this process flows continuously. The sludge builds up a sheet of material which holds back the finer particles and as the screen emerges from the water this sheet of sludge is picked up on a traveling felt belt similar to the wet machine used in the paper industry. The belt and sludge are passed through squeezing rollers where some of the water is pressed out and the sludge then leaves the belt in a thin sheet which has a water content of about 80%. The cost of this dewatering at Houston was said to be from $5 to $7 per ton of dry solids.

Final tanks. In all oxidizing processes other than sand beds it is necessary to settle the effluent. The present tendency is definitely toward removing the sludge from such settling tanks at fairly frequent intervals, if not continuously, by the aid the Dorr thickeners, which facilitate the delivery to a sump of the solids deposited on the floor of the tank.

Direct oxidation. Mr. Fuller finally gave at some length a description of the electrolytic or direct oxidation process, the discussion of which in his paper and by others has already been presented in these pages.

South Carolina Electric Power Plants

The Southern Power Company has announced that its ambitious construction program begun in 1922 and estimated to cost sixteen million dollars will be completed in 1923. The plans include two hydro-electric plants, one at Mountain Island in North Carolina and the other at Great Falls, S. C., both on the Catawba River. The former will develop 80,000 h.p. and the latter 60,000 h.p.

Separate or Combined Sewers

Advantages of each discussed and an illustration of the comparative cost of each for a specific case.

In a paper before the American Society for Municipal Improvements discussing the abuse of separate sewers and storm water drains, Harrison P. Eddy presented figures obtained from actual bids applied to alternative designs for a specific case, thus affording an unusual opportunity for comparing costs of the different systems. This part of his paper is given below:

The construction of a system of separate sewers without a system of storm drains, or with only a partial one, has become common practice in small communities and is somewhat prevalent in the larger cities. This has been based generally on economic necessity, either real or fancied as the case may have been. As it is rather unusual to make complete accurate estimates of cost of the two systems under consideration it may add interest to illustrate the subject by a case in which three plans were designed complete and estimates of cost of all three systems were based upon the lowest bid of contractors upon one of the systems. The six proposals were received under the unit price form of contract and were capable of application with a good degree of accuracy to the other two plans upon which bids were not invited.

The sewer district comprised an area of 305 acres. The topography was such that the sewers could be provided with good slopes. Sewers were designed to serve all building lots, and in the case of the partial system of storm drains the drains were provided to serve all the inlets required for proper drainage of the streets, without allowing water to flow across street intersections. The drainage system so built would accommodate 70 per cent. of the houses of the entire tract. The ultimate complete development of this district will provide about 7.4 building lots per acre of gross area (including streets). This is equivalent to a total of 2,257 lots. In some cases the sewer and the storm drain connections will be in the same trench in the streets and a portion of the private premises; in others, they will be mostly in different trenches. In many cases the roof leaders will connect with pipes laid outside the buildings, but in some instances they will connect with iron pipes in the cellars. In the estimate which follows the allowances for the house connections are such as to cover, on the average, the several conditions described.

In this illustration the sewers and storm drains were designed to be built in separate trenches except where the drains were 30 inches or more in size. Some reduction in cost might result from putting both pipes in one trench in all cases.

A comparison of costs should include the cost to property owners of the work which they will be required to do, such as the making of duplicate connections, and where drains are not provided the placing of pavement around buildings to receive the drip from eaves and the carrying of roof water pipes under lawns and sidewalks to gutters. In the following estimates, however, only the estimated cost of house connections extending from the common sewers and drains to the soil pipes and roof leaders has been added to the estimated cost of the common sewers and drains. The estimates of cost of the three projects are given in the table.

Estimate of Cost of Sewers, Storm Drains and House Connections—1920.

Type of System	Cost of Sewers or Sewers and Drains	Cost of House Connections Work in Streets	Work in Private Property	Total Cost
Combined sewers....	$476,625 (72.7%)	$56,425 (8.6%)	$122,600 (18.7%)	$655,650 (100%)
Separate sewers and partial system of storm drains.....	477,700 (68.7%)	80,125 (11.6%)	140,900 (19.7%)	698,725 (100%)
Separate sewers and complete system of storm drains.....	524,850 (67.2%)	90,280 (11.6%)	164,900 (21.2%)	780,030 (100%)

The estimates indicate that under the conditions of this case the combined system would be substantially cheaper than the system of separate sewers and a partial or incomplete system of storm drains, and considerably less expensive than the complete systems of separate sewers and storm drains. Of the total expenditure approximately 30 per cent. is required for house connections and drains around the houses to collect roof water. About two-thirds of this amount is for work in private property.

Such estimates are open to attack on a number of grounds. It is seldom that all abutting lots are built upon at the outset. An adjustment in costs might therefore be made on account of saving in interest. More important would be the probable saving due to the postponement of construction of some of the drains. The estimate therefore is applicable only to this specific case and is used merely to illustrate general tendencies.

Sedgwick Lecture on Public Health

For the purpose of commemorating the services of William Thompson Sedgwick, professor in the Massachusetts Institute of Technology, to the cause of biology and public health, a memorial lectureship has been established to the end that there shall be given each year by men of eminence in subjects comprehended within the general scope of biology and public health, lectures on different phases of those subjects. The first lecture was given in Huntington Hall, Boston, on Friday, December 29th, by Edmund

Beecher Wilson, daCosta professor of zoology, Columbia University, the subject being, "The Physical Basis of Life." The lecture was free to the public.

Water Works Superintendents and Fire Fighting

Their responsibility for the service rendered by the water department in minimizing fire losses.

The assistant to the chief engineer of the Southeastern Underwriters Association, W. T. Cates, presented at the annual meeting of the North Carolina Section of the American Water Works Association a paper entitled, "The Water Works Superintendent's Responsibility for Fire Fighting," in which he aimed to enlist the interest of water works superintendents in a greater appreciation of their responsibilities in this respect.

He referred to the "grading schedule" of the Underwriters Association in which, of the 5,000 points of total deficiency used in grading cities on the basis of probability of fire loss, water supply is assigned 34%, the fire department 30%, fire alarm 11%, structural conditions 14%, and the police, building laws, and hazards the remaining 11%. This shows that the fire underwriters consider the condition of the water supply to be more important even than the fire department.

The subject of water supply is divided in the schedule into various items, important among which are the selection and retention of officials and employees and the qualification of the superintendent; selection under civil service being considered desirable and long retention of efficient superintendents and employees.

Mr. Cates considered the inspection of valves and hydrants most important. "Broken valve stems with the valve left closed on some supply line, or hydrants with damaged valves or worn threads on the outlets, have often meant failure to obtain a prompt supply of water and consequent heavy damage to valuable buildings and contents." He cited one city where, although the plan of the distribution system indicated that a certain section should have good water protection, a test of the fire hydrants showed that it did not and it was rated accordingly. Some years later a neglected and overlooked partially closed valve in the main was found, and upon opening this valve the necessary supply and pressure were obtained.

Because the use of hydrants by sprinkler carts has caused nuts or valve stems and valves to be so worn as to be at times unoperative, and the threads on outlets so worn that under high pressure the hose coupling has been blown off the hydrant, he urgently recommended that special hydrants for use by sprinkler carts be provided and use of regular fire hydrants by them be prohibited. He also recommended that valves be thoroughly inspected and that only those turning in one direction be permitted to remain in any system.

Finally, he outlined the more important items under eleven heads. The first was: Complete records, plans and maps of the physical structures and operation of the system. Second: Emergency crews with wagon loaded with the necessary tools in the larger cities, and some one responsible employee in the smaller cities, to respond to all alarms in the mercantile district and on call elsewhere. Third: Some method for notifying the superintendent or some responsible employee of an alarm of fire. If pressure is to be raised or pumps speeded up, the pumping station should be notified of an alarm and also when the fire has been extinguished. Fourth: The superintendent is responsible for the extensions of the system and should insure that they have sufficient capacity and also that the source of supply should be increased when necessary as well as the storage capacity, and that pumps, compressors, boilers and motors should be kept in condition to supply full capacity at all times. Fifth: At least five days' supply of fuel should be in reserve at the station under normal conditions, and even more under abnormal conditions such as long hauls, bad roads, etc. The station itself should be well protected from fire. Sixth: In making extensions no pipes smaller than six inches should be used. Seventh: Dead ends in mains should be avoided where possible; if used, the size of pipe should give a capacity at least that of a 6-inch loop. Eighth: Pipes used should have the strength provided by the specifications of the American Water Works Association. Ninth: There should be sufficient gate valves to control each 500 feet of pipe in the mercantile district and not more than 800 feet in other sections. All valves should be inspected at least once a year and kept in good condition at all times. Tenth: The hydrant outlets should be sufficient in number "to discharge two-thirds of the required flow about any block or group of buildings in the mercantile, manufacturing and warehouse districts, and five hundred gallons or more in other districts." Every hydrant should be inspected at least twice a year, after fires, and oftener if necessary to maintain them in good condition. Eleventh: Full cooperation should be maintained between the water works superintendent and the chief of the fire department.

Public Improvements in Denver

During the closing months of 1922 the city administration in Denver inaugurated new improvement projects totaling more than $1,673,000, in addition to new storm sewers contemplated at a cost of about a million dollars and a considerable amount of other work. The improvements include sewers in a number of districts, paving and other work, which bring the total public improvements to be completed in 1923 up to a total of nearly $3,700,000, or twice as much as has ever been done in one year in the history of the city. During 1922 the total amount expended was $832,350.

Terms for Water Works Bonds

Conclusions of Charles W. Sherman concerning average life, depreciation, residual value, and, based thereon, the term for which water works bonds should be issued.

Under the title, "The Proper Term for Which Water Works Bonds Should Run," Charles W. Sherman of the engineering firm of Metcalf and Eddy read a paper before the New England Water Works Association giving a quite thorough discussion of this subject. He first considered the life of each of the different features of a water works plant and then considered the remaining life of a plant which had been built in a number of installments, as the basis for the term of bonds to be issued with the plant as security. He gave special consideration to the Massachusetts laws on the subject and described in detail as an illustration the present situation at Belmont, Massachusetts.

The paper is too long to permit reproduction in this journal and at the same time is so concisely stated that it does not seem practicable to give an abstract, but the author's conclusions, summarizing the paper, are as follows:

"1. The average life for a 'typical' water works plant in this country is about 50 years. It will rarely be less than this in individual cases, and may be as much as 60 years or more for some works.

"2. Complete records of depreciation, including abandoned structures, of a number of water works plants of considerable age show that the total accrued depreciation of the physical plant of such works is about 20% of the cost. Departures from this mean are not great. Records of depreciation suffered by the plant still in service, modified by a suitable allowance for plant abandoned, confirm this as a reasonable normal figure.

"3. The corresponding average age for works of 50 years' life is 20 years, leaving 30 years average remaining life. If the average useful life were 60 years instead of 50, the average age would be 27 years and the remaining life 33 years. Thirty years is a fair estimate of the average remaining life of any water works plant in normal condition, and therefore a proper term for which water works bonds should run.

"4. If the works have suffered a depreciation of 20%, including abandoned property, there is a residual value of 80% of cost of the physical plant. Water works bonds may therefore safely be issued up to 80% of the normal cost of the works.

"5. Municipally owned water works should be self-supporting and their financing should be on the same general basis as that of private corporations.

"6. The clause of the present Massachusetts law which limits bonds for the extension of municipally owned water works to a term of 5 years is illogical and burdensome, and should be repealed.

"7. Special legislation for particular cases, made necessary by the existence of the 5-year limit, is undesirable from every point of view.

"8. Suitable control over municipal bonds for water works purposes can be exercised by requiring the approval of the Public Utilities Commissioners in exactly the same way as for bonds of a private water company.

"9. Misuse of water revenues can be avoided by legislation limiting their uses to water works purposes."

The Use of Filter Re-Wash*

By J. H. Suggs†

Too rapid admission of re-wash water gives objectionable results. Remedies proposed.

My subject, "The Use of Filter Re-wash," should perhaps be more properly entitled "The Abuse of the Filter Re-wash."

When a filter is first washed we all know that the effluent for the first few minutes of operation of the filter is not of a satisfactory quality, the quality depending largely upon how thoroughly we have washed the filter.

In a large filter plant with a great many units which are not all washed at the same time, a filter can be placed into service immediately after washing, probably without very much damage to the effluent of the plant as a whole.

In a smaller plant with a smaller number of units, in which it is the practice to wash the entire plant at one time, serious harm will be done to the effluent of the plant if all of the filters are put into operation at one time at full rate, as all of the water at that time, while not necessarily of a low quality, is certainly not what it should be.

In most plants I believe, and certainly it has been the practice with us, the first effluent from the filter after washing is wasted to the sewer, and this is what we know as the re-wash.

The point I wish to bring out at this time is that if the re-wash is properly used, while it wastes some water, it enables us to maintain at all times a high standard of effluent, but if used improperly more harm is done than good.

The purpose of the re-wash is really to age the sand bed by the accumulation of a new deck of floc uniformly over the entire area of our sand bed and in the upper layers, so that while the filter is in operation the water will pass uniformly at the same rate through the entire bed.

The re-wash connection on most filters is so large

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that if opened wide the water will pass through the bed at many times the normal rate of filtration. If the plant is operated entirely by hydraulic valves it is a rather difficult matter for the operator to control the amount of opening of the re-wash valve; and, therefore, particularly because a valve when it is part-way open will pass nearly as much water as it will when it is wide open, it is almost impossible for the operator to avoid passing through the re-wash as much water as it will carry.

The result of this is that, instead of the filter bed reaching a uniform condition in a few minutes, there are holes formed in the sand bed through which the water passes very rapidly, preventing the accumulation of any floc; and if the filter is then turned into service after a few minutes use of the re-wash, a low quality of effluent will be obtained throughout the entire run of the filter.

The next time the filter is washed this condition is corrected and if the re-wash valve is properly used at this time the same filter will produce a satisfactory effluent without apparently any reason for it.

We have found this to be true in our own plant and by very careful attention to the opening of the re-wash valve, making certain that the amount of water passing to the sewers is not in excess of the normal rate of the filter, we are now experiencing no difficulty from this feature and we are now contemplating, as soon as the work can be done, the installation of a choke in our re-wash connection that will make us independent of the opening of the re-wash valve and we can open this valve wide open with the assurance that no damage will be done to the sand bed.

We understand that this is being done in some of the more modern plants at the present time by using a very small re-wash connection.

My own opinion is that if a re-wash valve is not properly used, since there is no controller on such connections, that it would be far better to simply put the filter into regular operation at a low rate, slowly building it up to the rate we wish to carry, keeping it on your controller at all times. While this would pass some water not strictly up to what it should be it will only do so for a short time and the sand bed will at least be in condition for a satisfactory run until the next washing.

Growing Willows on Sewage Farms

The growing of willows on sewage farms is being advocated in England as a means of securing some returns from sewage disposal. The willows recommended are those known commercially in that country as "cricket bat willows," and it is stated that the average price obtained is $15 per tree, and that from 250 to 350 trees are grown on an acre, reaching maturity in twelve to fifteen years. It is reported that Glastonbury disposed of 63 willow trees to a manufacturer of cricket bats for about $2,500. These trees had been purchased in 1903 at a total cost of not more than $100, including planting and freight charges.

As there are about 90 different varieties of willows, it is essential that the trees should be carefully selected to be of the right variety, or they might find no market.

Study of Arch Dams

A nation-wide study of arch dams is about to be undertaken by the Engineering Foundation in cooperation with engineers of the west. The Engineering Foundation has appointed a committee of civil engineers consisting of Arthur P. Davis, director of the U. S. Reclamation Service; A. B. Fletcher, director of Public Works at Sacramento; M. M. O'Shaughnessy, city engineer of San Francisco; H. Hobart Porter and Silas H. Woodward, of New York; Prof. C. Derleth, Jr., of the University of California; F. A. Noltzli, of San Francisco; H. Hawgood, of Los Angeles, and D. C. Henny, of Portland, Ore.

This committee is collecting information from the owners of existing dams and plans to make measurements of existing dams and of those which are to be constructed in the near future, to learn as much as possible about their performance under different conditions of temperature and of depth of water in the reservoir. In addition, it is proposed to build one or more small dams for experimental purposes upon which tests can be made to try various theories and get information which it is not possible to obtain by measurements of existing dams.

Costs Are Increasing

All records concerning contracting and the construction business have indicated that during the past few months wages and prices have been advancing. The official organ of the Associated General Contractors expresses the belief that prices in general have been stabilized for the present on a new price level in the neighborhood of 70% higher than that which prevailed in 1913. "This means that prices will continue to go up until the present period of prosperity is fully established and will not go down again until the beginning of the next business depression. The next depression will probably be only a moderate one—such as we were familiar with before the war—and will be accompanied by only moderate decreases in prices.

"Instead of expecting that building costs will be materially lower eighteen months from now, we anticipate they will continue to increase during the greater part of that period and that they will be at that time perhaps at about the beginning of a decrease, but at a point higher than at present. We believe, further, that the decrease which may be expected to begin at about that time will not go to a point very much below the figures reached during the winter of 1921-22."

Delaware Highway Income

The State Highway Department of Delaware obtains almost its entire income from motor vehicle fees, the only additional income last year having been $49,000 appropriated by the State Legislature.

The state highway system has cost up to date $10,862,000 and includes 263 miles of road. Of this amount $7,450,000 has been paid from state and county funds. It is estimated that double this amount was spent in one year for automobiles owned by citizens.

Refuse Collection and Disposal Data*

Information furnished by several hundred municipal officials concerning the practices of their cities in collecting garbage, ashes and rubbish and in disposing of them.—(Continued from the December issue)

ELY, MINNESOTA

Ely, Minnesota, collects garbage by municipal employees and the city furnishes the garbage cans for each residence and business place. The population is about 5,000. About 750 garbage cans are in service, 200 being 6-gallon, 350 8-gallon, and 200 12-gallon. Garbage is collected from the business section every day and from residences every other day, Sundays excepted. The garbage is collected in a water-tight wagon of 2½ cubic yards capacity and the excess water is drained into the sewer at convenient places.

JOPLIN, MISSOURI

At Joplin, Missouri, garbage is collected by an association formed by the leading hotels of the city, which owns a hog ranch and collects the garbage from the entire city without cost to either city or property owners.

HASTINGS, NEBRASKA

Hastings, Nebraska, guarantees a local truckman $150 a month for collecting the garbage, the truckman soliciting the business and collecting $1.00 a month for each residence and $5.00 for markets and other commercial establishments. If the income exceeds $150 a month, the difference is divided equally between the city and the truckman.

MONTCLAIR, NEW JERSEY

In Montclair, New Jersey, population about 30,000, garbage is collected by municipal employees and sold to farmers for hog feeding, being delivered to them by the municipality. All the farmers are within the limits of a five-mile haul. For collecting the garbage, 2½-ton Packard trucks are used, with special 4-yard bodies. Three trucks are used during seven months of the year and four trucks during the other five months. Each truck has one chauffeur and three or four helpers. Collections are made twice per week for seven months and three times for five months, with extra collections from fish markets, boarding houses, etc. The number of loads varies from 33 to 50 per week, averaging 40, and averaging 3½ cubic yards per load. The farmers pay an average of $1.00 per load. Bids for the garbage were received the first of the year and the demand exceeded the supply by 40 per cent.

In Montclair rubbish and ashes are collected by municipal employees. The rubbish carts are of 7 cubic yards capacity, five carts being used. Only one man, the driver, is used with each cart, except that in the business district there is a helper. Collections are made once a week from all buildings and an average of fifty loads a week is collected. The rubbish collected is hauled to a dump near one end of the town, where all inflammable matter is burned in an open pit. Two men are employed at this dump. Ashes are collected twice a week for 7½ months of the year and once a week during the other 4½ months. Horse-drawn wagons are used, of 3½ cubic yards capacity, three being used in summer and about 10 in winter; three helpers being used in summer and an average of 20 in winter. The ashes are used for filling low land and surfacing some of the outlying streets.

The garbage trucks are all equipped with snow plows and are used for plowing the streets after a snowstorm. Following the severe storm early in 1922 a roadway fifteen feet or more wide was plowed on over 70 miles of streets within 24 hours after the storm had ceased.

PATERSON, NEW JERSEY

Paterson, New Jersey, collects all refuse with municipal teams and employees, the garbage and combustible refuse being taken to an incinerator. In the collection service the city uses electric tractors, gasoline trucks and horse-drawn wagons, the last-named being hired at $10 per day. During the year 1921, 57,381 cubic yards were hauled by electric tractors at a cost of 49.64 cents per cubic yard, plus 10.45 cents for overhead. The gasoline trucks collected 35,071 cubic yards at a cost of 67.33 cents per cubic yard, plus 11.40 cents overhead. The horse-drawn wagons collected 84,317 cubic yards, or nearly as much as the other two combined, at a cost of 64.04 cents per cubic yard. This gives a total of 176,769 cubic yards removed at a total cost, including overhead, of $130,828. Of this amount, 142,193 cubic yards was disposed of on dumps, the cost of maintaining which was 10.36 cents per cubic yard, which is included in the total just given.

The destructor plant during the year incinerated 34,576 cubic yards of material at a cost of $12,914 for wages and $3,031 for maintenance, an average of 46.11 cents per cubic yard; in addition to which the carting of the clinker from the plant cost $2,392 for removing the 2,087 cubic yards of clinker.

Of the cost for the electric tractors, which have

*Continued from page 284.

a capacity of 10 cubic yards each, 41.08 cents per cubic yard was for labor, 2.03 cents for current, 6.49 cents for maintenance. Of the cost of collecting by gasoline trucks, with capacities of 5 and 10 cubic yards, 51.45 cents was for labor, 5.90 cents for gasoline and 9.97 cents for maintenance. An inspection of the monthly records shows that horse collection was used to a larger extent during the winter months, the amount collected per month by horse-drawn wagons between April and October being only from one-quarter to one-half as much as during the winter. The amount collected per month by the electric tractors and gasoline trucks shows comparatively little variation between the monthly collections, indicating that the hired horse-drawn wagons are used largely for making up the deficiency in capacity of the city-owned equipment.

SUMMIT, NEW JERSEY

Summit, New Jersey, reports an unusual feature, found in very few other cities—that of the collection of refuse from the cellars of all householders who may wish it and who sign an application releasing the city from any liability of any character.

BUFFALO, NEW YORK

Buffalo, New York, collects all ashes, garbage and rubbish, insisting upon separation into these three classes, the ashes to contain also broken crockery, etc. Ashes and rubbish must be in receptacles weighing not over 100 pounds and the garbage in water-tight ones. For garbage, the tractor and trailer system is used, the trailers being horse-drawn, of 5-yards water-level capacity, side dump, with a fifth wheel. For ashes, wagons are used having a capacity of 5½ yards water level and of the bottom-dump type. The rubbish wagons have a capacity of 18 yards level full or 24 yards rounded up.

The tractors haul three trailers of garbage to a piggery 3½ miles beyond the city limits, with an average haul of nine miles through the city. The ash wagons drive directly to the various dumps, the average haul being 3 miles. The rubbish wagons go directly to the refuse utilization plant, the average haul being 6 miles. Here the contents are dumped into bins and from these put on conveyors, where they are sorted by women. The unsaleable residue is carried by the conveyors to the top of six Heenan-Froude furnaces, in which this material is burned. Steam is generated from the heat and is used for operating the machinery of the plant and for part of the power needed to operate the sewage pumping station which is adjacent to the plant.

The cost per yard during 1921 was as follows: For ashes, from a minimum of 52 cents per yard in December to a maximum of 91 cents in September, or an average of 69½ cents for the year. For garbage, from a minimum of $1.63 in September to a maximum of $3.15 in January, an average of $2.15. For rubbish, from a minimum of 45 cents in July to a maximum of 75 cents in January, an average of 59 cents. The total cost for the year ending June 30, 1922, for the collection of all refuse was $764,881.

HORNELL, NEW YORK

At Hornell, New York, garbage is collected by a private concern which changes the cans and sterilizes them once a week, charging the householder 85 cents per month. The garbage is fed to hogs.

ELLWOOD CITY, PENNSYLVANIA

Ellwood City, Pennsylvania, is one of the comparatively few municipalities that require citizens to wrap the garbage in paper. The garbage is burned in an incinerator.

OGDEN, UTAH

Ogden, Utah, is another city where the contractor for collecting the garbage furnishes the cans. He cleans the cans by steam. Collections are made daily in the business district. No charge is made to private citizens and the garbage is used for feed at the packing plant.

SEATTLE, WASHINGTON

An advantage of municipal collection of garbage over any collection where each property holder must pay the collector directly is stated by A. H. Dimock, city engineer of Seattle, to be that "there is no incentive for anyone to dispose of garbage on his own property or on vacant property belonging to other people in order to avoid the payment of collection charges. This happened very frequently before the city undertook to collect the garbage itself, but under the present plan all old sources of offense have been cleaned up and no new ones appear. Because of the thorough collection of all wastes, Seattle has become practically a flyless city. This again reacts in promoting the public health, although of course the value of this cannot be stated in figures."

MAKING FILL

KENOSHA, WISCONSIN

In Kenosha, Wisconsin, all refuse is dumped in the lake back of a breakwater and is covered with dirt from excavations. This is used for making a fill which is to be developed as a lake shore park and has been found very satisfactory. It is calculated that the value of the land reclaimed in one year was $27,500, while the total cost in 1921, including depreciation and interest, was $40,608. The equipment used is four Lee trailers, four trucks and six horses. The cost per cubic yard averaged $1.65 and the cost per capita per year about $1.00.

OAKLAND, CALIFORNIA

The mixed rubbish of Oakland, California, is dumped on a tidal flat as fill for future extension of the industrial district. The city has built a trestle onto the flat to facilitate the dumping and employs men to regulate it. Last year the cost to the city of this dump was about $20,000. A serious objection to the dump is the large number of flies and rats that infest it.

WILLMAR, MINNESOTA

Willmar, Minnesota, has no regular collection of garbage, but provides a city dump where it is delivered to teamsters. The city employs a man to go to the dump one day a week and cover all of the week's accumulation of garbage, and it is

(*Continued on page 29*)

ASH AND RUBBISH DISPOSAL

City	Method of disposal	Cost per year.	Average haul, miles.	Satisfactory?—Remarks
Alabama:				
Fairfield	Dump outside city, burn*	Nothing	....	Very
Birmingham	Open dump	.....	2	No
Mobile	Fill swamp	.....	2½	So far
Talladega	On dump	Nothing	1	No
Arizona:				
Clifton	On dump, burned	$300	2	Yes
Miami	Home-made incinerator*	.....	1	Yes
Tucson	On dump*	Nominal	4	No
Arkansas:				
Helena	Dumped on levee, burned	.....	....	Yes. River removes dump
Pine Bluff	Dumped over bluff at river, burned	.....	....	.....
California:				
Alameda	Dumped at one end of town	.....	....	.....
Glendale	City dump, burned; paper baled	.....	....	.....
Long Beach	Sorted, sold or burned	.....	....	Revenue less than cost of sorting
Marysville	Burned*	$360	2	No
Oakland	Dumped as fill on tide flat*	$20,000	....	Cheapest method. Flies and rats at dump objectionable
Ontario	Filling waste land	.....	2	At present
Petaluma	Dumped at sewer farm*	.....	....	.....
Richmond	Burned with oil in out-of-the-way places	.....	....	.....
Sacramento	Dumped in cuts & covered	.....	2	Fairly
San Gabriel	Dumped in arroyo	.....	2	Yes
Santa Ana	Dumped on river bank	.....	6	Yes
So. Pasadena	Fill low ground	.....	1	Yes
Stockton	Dumped on leased land	.....	2½	Fairly satisfactory
Upland	Dumped in a wash	.....	....	Yes
Colorado:				
Denver	City dump	$5,000	2½	Yes
Fort Collins	Dumped	$300	2	Yes
Greeley	Dumped	$500	¾	.....
Salida	Dumped and covered	.....	....	.....
Connecticut:				
Bridgeport	Ashes dumped	.....	....	.....
Bristol	Ashes dumped	.....	....	.....
Hartford	On twelve fills	.....	1	Yes
Middletown	Dumped	None	1½	Yes
New Britain	Dumped	$1,500	....	.....
New Haven	Dumped	$8,000	2	Yes
New London	Dumped on city land	.....	Approx. 1	Fairly so
Norwalk	Make fill	.....	1	Yes
Manchester	On two town dumps	.....	....	So far
Willimantic	City dumps	.....	1	Yes
District of Columbia:				
Washington	Ashes dumped, rubbish salvaged	Insignificant	2½	Yes
Florida:				
Clearwater	Dumped far from town	.....	....	Quite
Fort Myers	Burned out of town	.....	....	.....
Jacksonville	2 incinerators and fill	.....	....	.....
St. Petersburg	Piled on dump	$2,000	2	No
Sanford	Incinerator	....	1½	Yes
Georgia:				
Albany	Building land	20	½	Yes
Griffin	Incinerator	.....	....	.....
La Grange	Public dump	.....	1	.....
Rome	Open dump*	2,500	1	No
Idaho:				
Caldwell	Dumped	.....	1	No
Pocatello	Dumped	360	3	Yes
Twin Falls	Make streets	None	1½	Yes
Illinois:				
Blue Island	Dumped in clay hole	12,000	2	At present
Champaign	Fill low land	.....	....	Fairly so
Chicago	Dumped	$1.17 per cu. yd.	3	For ashes, yes; for rubbish, no
Chicago Heights	Dumped in quarry	.....	....	Yes
E. Moline	Dumped at end of town	.....	....	Increasingly unsatisfactory
Evanston	City dump; some ashes on street	.....	....	.....
Galesburg	Incinerator	.....	1½	Very
Glencoe	Combustible burned on dump, other on roads	.....	....	Fairly so
Joliet	Ashes on city dump	.....	....	.....
Kewanee	Combustible burned, other on low lots	.....	....	.....
Lincoln	City dump	.....	3	Yes
Oak Park	Dump	500	6½	Yes
Quincy	Dumps	.....	....	No
Indiana				
Columbus	Public dump	None	1	Yes
Elwood	Dumped at edge of city	.....	....	Fairly so
Mishawaka	Dump	300	1	Yes
Peru	Filling low land	.....	2	.....
Portland	Dump	$360	2-4	Yes
Richmond	Fill	.....	1¾	Yes
Shelbyville	Dump	.....	¾	.....
South Bend	Gravel pits	.....	....	.....
Valparaiso	Hauled to dump	100	1	Yes
Wabash	Ashes in alleys	500	Short	Yes
Iowa:				
Cedar Rapids	Fill lowlands	None	....	Yes
Charles City	2 dumps	.....	....	.....
Creston	Ashes on streets; rubbish on city dump	.....	....	Quite so
Davenport	Sanitary fill*	3,500	.....	Quite so
Dubuque	Fill low land	.....	....	Fairly so
Keokuk	Private	.....	....	Yes
Marshall	Dump	.....	2	Yes
Mason City	City dump	.....	1½	No
Muscatine	City dump	.....	....	.....
Ottumwa	Fill	.....	....	.....

For foot notes, see page 29

ASH AND RUBBISH DISPOSAL—(Continued)

City	Method of disposal.	Cost per year.	Average haul, miles.	Satisfactory?—Remarks
Kansas:				
El Dorado	Dumped	.....	....	Not entirely
Salina	Dumped	$125	1¼	.....
Kentucky:				
Ashland	Incinerator* and dump	900†	....	No
Fort Thomas	Filling	150	1	.....
Paducah	City dumps	.....	¾	Yes
Louisiana:				
New Orleans	Dumped on swamp, burned*	36,000	7	Incinerators under construction
Maine:				
Augusta	City dump	None	¾	Yes, for present
Old Town	Dump	336	2,000 ft.	Yes
Massachusetts:				
Adams	Public dump	300	2	Yes
Beverly	Filling streets, parks, etc.	.....	....	Yes
Dracut	Dumps	.....	½	.....
Fall River	Filling	.....	....	Yes
Fitchburg	Filling	.....	....	Yes
Haverhill	Dumps	.....	1	Yes
Holyoke	City dump—fill in ground	App. $7,000	1½	Yes
Ludlow	Town dump	15	1	Yes
Lynn	Nearest dump or fill	.....	....	.....
Malden	Fill	.....	¼	Yes
Medford	Dumps, paper sold	.....	1	.....
Middleboro	Public dump; some ashes for sidewalks	.....	....	.....
New Bedford	Fill & dump	.....	1	Yes
Newburyport	Fill river front	300	1¼	Yes
Newton	Fill—papers burned	.....	1½	Need incinerator
North Andover	Fill	.....	....	Yes
Orange	Rubbish dumped, burned	.....	....	Yes
Peabody	Dumps	.....	....	Very
Rockland	Fill	.....	....	Yes
Waltham	Fill for parks	.....	....	.....
Watertown	Private and public dumps	.....	1½	Yes
Winchester	Filling	1,000	½	Yes
Michigan				
Alma	Fill	None	¾	Yes
Ann Arbor	Dump	.....	1½	Fairly so
Detroit	Rubbish, dump; ashes, streets	2,000,000	4½	Yes
Flint	Rubbish, dump; ashes, streets	5,400	½	Yes
Highland Park	Dump	.....	4	Yes
Holland	Fill swamps	300	1	Yes
Ishpeming	Fill	.....	....	Yes
Jackson	Fill	100	1½	Yes
Lansing	Dump	.....	1	.....
Ludington	Dump	None	½	Yes
Monroe	Dump in swamp	800	1	Yes
Muskegon	Dump	None	15	No
Niles	Fill ravines	.....	1	.....
Owosso	City dump	.....	....	Yes
Pontiac	Dump	1,100	1½	Yes
Port Huron	Public dump	.....	....	Very
Sault Ste. Marie	City dump	.....	....	No
Sturgis	City dump	20	½	Yes
Minnesota:				
Austin	Fill	.....	1½	Yes
Brainerd	City dump*	.....	....	.....
Ely	Dump on low lots	.....	2½	.....
Fairmont	Dumped in gully, burned	.....	1	.....
Rochester	Dump	1,200	3	No
Mississippi:				
Hattiesburg	Incinerator or dump	.....	....	Not entirely
Natchez	Dumped in river and bayous	.....	....	.....
Missouri:				
Columbia	City dump	.....	2	No
Jefferson	City dump	.....	....	.....
Joplin	Public dump	.....	....	.....
Kansas City	Fill lowland	None	5	No
Sedalia	Dumps	.....	1	Yes
Springfield	Dump	.....	....	.....
Montana:				
Havre	City dump	.....	1	.....
Kalispell	Fill	700	2	Yes
Fremont	City dump	.....	....	Yes
Nebraska:				
Hastings	City farm	600	2	No
Lincoln	City land	750	....	.....
Omaha	Public dumps	.....	....	.....
Nevada:				
Winnemucca	City dump outside city	.....	....	.....
New Hampshire:				
Dover	Rubbish, incinerator; ashes, dump	.....	....	Fairly so
Franklin	Grading	.....	1½	.....
Keene	Incinerator	2,000	....	Yes
Laconia	Ashes, grading; rubbish, dump	.....	....	.....
Nashua	Dumps	1,000	1	Yes
New Jersey:				
Asbury Park	Ashes for streets, rubbish sorted	None	3	Yes
Atlantic City	Filling city or rented land	.....	1¾	Yes
Bergenfield	Public dump, covered with earth	.....	....	Yes
Freehold	Borough dump	.....	1	.....
Hackensack	Filling	.....	1	Yes
Irvington	Sanitary fill,* 30 ft. deep	.....	....	Yes
Millville	Fill	.....	....	No
Montclair	Rubbish dumped, burned. Ashes, fill	.....	....	Yes
Newark	Fill	12,000	2½	Yes
New Brunswick	Fill; combustible in incinerator	6,718	1	.....
Paterson	Garbage and refuse, incinerated; ashes, fill	Dump, $14,735 Incinerator, 18,336	....	.....

For foot notes, see page 29

ASH AND RUBBISH DISPOSAL—(Continued)

City	Method of disposal.	Cost per year.	Average haul, miles.	Satisfactory?—Remarks
New Jersey (Continued)				
Phillipsburg	Fill	.....	....	.....
Roselle Park	Dump and streets	$2,000	....	Yes
Spring Lake	Borough dump	None	1	Not entirely
Summit	Rubbish, dumped, burned; ashes, streets or private land	.....	....	Reasonably so
Westfield	Fill swamps	.....	....	No
New York:				
Albany	Ashes, public dumps	.....	....	.....
Amsterdam	In old canal	2,000	1	Yes
Auburn	Dumps	.....	1	Yes
Binghampton	Burned	.....	1½	Yes
Buffalo	Ashes, dumped; rubbish, sorted, incinerator	Profit	Ashes, 3; refuse, 6	Yes
Cortland	Dump	1,000	1	Yes
Glens Falls	Private lands or public dump	.....	....	Fairly
Hempstead	Ashes, roads	.....	2½	Yes
Hornell	City dump	.....	....	.....
Hudson	Ashes or dumps	.....	....	Yes
Kingston	Filling swamp	30,000	1½ to 2	Yes
Mineola	Public dump	.....	....	Neighbors complain
New York (Manhattan, Brooklyn Bronx Boroughs)	Filling city and private lands	About 3,000,000	2 to 10 by land and water	Creates valuable land
Niagara Falls	Into Niagara Rapids	.....	....	Yes
Oneida	City dump	.....	1	Yes
Ossining	Fill	.....	1	No
Poughkeepsie	Ashes, fill	.....	....	Yes
Syracuse	City dump	.....	....	.....
Tarrytown	Fill*	2,100	1	Yes
Utica	Fill	.....	1	For the present
Watervliet	Dump	.....	1	No
North Carolina				
Durham	Ashes, fill; rubbish, incinerators	.....	¾	Yes
Elizabeth City	Fill	4,271	½	No
Fayetteville	Fill and incinerator	.....	1	Yes
Goldsboro	Dump and incinerator	900	....	.....
Greensboro	Incinerator,* ashes, fill	.....	1½	Yes
Henderson	Dump	.....	2	No
Wilmington	Ashes, roads; rubbish, incinerator	.....	¾	Yes
North Dakota:				
Bismark	City dump	900	....	No
Fargo	Dump	.....	....	No
Jamestown	Potters field	300	1½	Yes
Mandan	Refuse, dump.	.....	1	Yes
Valley City	Refuse, city dump, sorted, burned	600	....	Yes
Washburn	Ashes, fill; rubbish, river bank	.....	....	.....
Ohio:				
Ashland	Dump	None	1½	Yes
Ashtabula	City dump	300	2	Partly
Bellefontaine	Dump	25	2	Yes
Bucyrus	Dump	None	½	Yes
Chillicothe	Dump	None	1	No
Circleville	Private dump	None	½	Yes
Columbus	Dumps in city	.....	....	Yes
Dayton	City dumps	.....	1½	Very
Delaware	City dump	None	....	.....
Freemont	Dump	.....	1	Yes
Galion	Dumps	.....	½	Yes
Portsmouth	Dumps*	None	2½	Yes
Urbana	City dump	.....	2	Yes
Wilmington	Fill	.....	....	Fairly so
Wooster	Private dumps	.....	....	No
Oklahoma:				
Ada	City dump	.....	3	Fairly so
Blackwell	Dump, burned	.....	3	No
Enid	Dump, burned	540	3	No
Oregon:				
Astoria	Dump, burned*	.....	....	No, fire fumes objectionable
Eugene	City dump	.....	....	Very
Klamath Falls	Private dump, burned*	.....	....	No
La Grande	Dump	.....	2¾	No
Pennsylvania.				
Altoona	.....	None	1½	Yes
Ashland	Dump	.....	1	.....
Berwick	Dump into river	.....	....	No
Bethlehem	City dumps	.....	....	Yes
Bloomsburg	Fill*	.....	2	Yes
Braddock	Combustible, incinerator; other, dump	.....	....	Yes
Carlisle	City dump	200	¾	No
Coatesville	Quarry holes	None	½	Yes
Dormont	Dump	.....	3	No
DuBois	Streets and swamp	.....	¾	Yes
Duquesne	City and private dumps	.....	....	.....
Easton	Combustible, incinerator; non-combustible, dump	880	1½	Yes
Erie	Dumps	$3,000	....	
Franklin	City and private dumps, burned	960	....	.....
Freeland	Dump	None	¾	Yes
Greenville	Dump	500	2	No
Hanover	Old quarries*	.....	....	Yes
Kittaning	Dump	.....	3	.....
Lebanon	Old quarries	.....	2	No
Lewistown	Dump	500	½	No
Meadville	Ashes, dump; rubbish, incinerator	.....	1½	Yes
New Brighton	Public dumps	.....	¾	No
Parkesburg	Public dump*	.....	....	Fairly so
Pittston	Ashes, streets; rubbish, dumped, burned	.....	¾	Yes

For foot notes, see page 29

ASH AND RUBBISH DISPOSAL—(Continued)

City	Method of disposal.	Cost per year.	Average haul, miles.	Satisfactory?—Remarks
Pennsylvania (Continued)				
Rankin	Dump	.....	¾	Yes
Steelton	Private dump	None	1	Yes
Summit Hill	Dump	.....	½	Yes
W. Pittston	On river bank	.....	1½	Yes
Williamsport	Old "log basins"*	.....	....	Yes
Winton	Dumped in mine cover	.....	Short	Yes
Rhode Island:				
Newport	Public dumps	2,606	....	Yes
South Carolina:				
Charleston	Dumped on salt marshes	.....	....	.....
Chester	Dumped in gullies, burned	.....	....	.....
Spartansburg	Dumped	.....	1	Yes
Tennessee:				
Memphis	On low lands	3,600	2½	Yes
Morristown	Dumped	.....	1	No
Texas:				
Amarillo	Incinerator	.....	....	Yes
Beaumont	Fill marsh	.....	1½	Yes
Dallas	Rubbish, incinerator*	.....	1½	Yes
Eagle Pass	Dump	.....	....	No
Eastland	Dump. Rubbish burned	$100	None	Yes
Galveston	Incinerator and burned at dump	7,128	....	Yes
McKinney	Incinerator	.....	....	.....
Navasota	Holes and dump	.....	1	No
Port Arthur	Fill	None	....	Yes
Utah:				
Brigham	City dump	25	1½	Yes
Ogden	Dumped in holes and covered	.....	....	.....
Vermont:				
Barre	Municipal dump; ashes on roads and lots	.....	....	Yes
Bennington	Dump	.....	3	No
Burlington	City dump	1,316	1	Not entirely
Virginia:				
Bristol	Dumps	.....	¾	Yes
Danville	On river bank*	.....	2	No
Fredericksburg	City dump	100	1¼	Yes
Lynchburg	Dumps	200	½	Yes
Newport News	Dump*	.....	1¾	For ashes
Petersburg	Dump	6,000	1½	Yes
Portsmouth	Combustible,* incinerator; other, city dumps	.....	....	Fairly so
Richmond	Dump	$150,689.12	1¼	Yes
Roanoke	Combustible,* incinerator; other, dump	.....	1	Yes
Washington:				
Chehalis	City dump,* burned	.....	....	.....
Seattle	Sanitary fill*	.....	....	Very
Spokane	Fill	$150	¾	Yes
Walla Walla	City dump, burned	600	2½	Yes
West Virginia				
Clarksburg	Dumped in ravine	.....	2	Yes
Huntington	Dump‡	800	2	Yes
Wisconsin:				
Appleton	City dump	.....	....	.....
Baraboo	Ashes, streets; rubbish, dump leased by city	.....	....	.....
Beaver Dam	Fill	None	2	.....
Fond du Lac	Ashes, streets and low land	.....	....	.....
Green Bay	Fill sloughs	None	1	Yes
Kenosha	In lake back of breakwater, covered with dirt, for park	.....	....	Very
Lake Geneva	Gravel pit in city	.....	....	No
Menasha	City dump	5,000	¾	Yes
Milwaukee	Incinerator*	.....	....	Perfectly except cost
Racine	Fills; combustible,* incinerator	None	¾	Yes
Sheboygan	Dump	.....	1	For the present
Wisconsin Rapids	Dump*	.....	2	For ashes
Wyoming:				
Cheyenne	City dump*	.....	2	Yes
Sheridan	City dump	.....	....	.....

*Includes garbage. †Cost of care of dump. For incinerator see garbage. ‡No ashes in city.

(*Continued from page 25*)

reported that no nuisance is occasioned. The dump is on the edge of the city.

IRVINGTON, NEW JERSEY

Irvington, New Jersey, collects ashes and garbage by municipal employees and dumps them on low land. The dump is covered with a liberal coating of earth and once a year is given a treatment of disinfectant. Land lately acquired is being filled to a depth of approximately 30 feet and is large enough, it is estimated, to receive the refuse for five years to come.

JAMESTOWN, NORTH DAKOTA

The satisfactoriness of dumping garbage and refuse at Jamestown, North Dakota, is attributed by City Engineer Hurning to the fact that the city pays $25 per month to see that the garbage is properly covered with lighter material, but especially to the fact that the local teamster who makes the collections is industrious and active and that nature has provided the city with a dry climate and good drainage. Undoubtedly the factor of dry climate is much more favorable to disposal of garbage in dumps than is the climate of eastern and southern cities where moisture in the air favors rapid decomposition.

WILLIAMSPORT, PENNSYLVANIA

Williamsport, Pennsylvania, has an unusual opportunity for disposing of its refuse. The city is built on a flat along the Susquehanna river, having approximately seven miles river front and being 7/8 of a mile wide. Early in its history it was a lumber city and for several miles along the river log basins were constructed, into which the logs were drawn after being rafted down the

(*Continued on page 38*)

GARBAGE DISPOSAL

City	Method of Disposal	Cost of Operation, Per Year	Make and Capacity of Plant	Cost of Plant	Annual Maintenance and Repairs	Distance from Center of City	Is It Satisfactory? Remarks
Alabama:							
Birmingham	Open dump	$90,000	None	.....	.....	.....	Will install garbage disposal plant in near future
Mobile	Hauled to swamp and burned	.....	.....	.....	.....	1 mi.	.....
Selma	Dumped on land	.....	.....	.....	.....	.....	No
Talladega	Dump	.....	.....	.....	.....	1 mi.	No
Arizona:							
Clifton	Burned on dump	$4,500*	.....	.....	.....	2 mi.	Yes
Miami	Burned	.....	Home-made grate of iron pipe	.....	.....	1 mi.	Yes
Tucson	Garbage dump	.....	.....	.....	.....	4 mi.	No
Arkansas:							
Helena	River side of levee	.....	.....	.....	.....	.....	Yes
California:							
Marysville	Burned	.....	.....	.....	.....	.....	No
Napa	Dump on land	.....	.....	.....	.....	.....	.....
Ontario	Bus. sec. for hogs; rest on land	5,000	.....	.....	.....	2 mi.	Yes (at present)
Petaluma	Sewer farm	.....	.....	.....	.....	2 mi.	.....
Richmond	Burned	.....	.....	.....	.....	.....	Unsatisfactory—Dump where burned unsightly
Sacramento	Hog feed	.....	None	.....	.....	2 mi.	Fairly
San Bernardino	Fed to hogs	.....	.....	.....	.....	.....	.....
Santa Ana	Fed to hogs	.....	.....	.....	.....	6 mi.	.....
So. Pasadena	Sold to hog farm	4,200	.....	.....	.....	6 mi.	Yes
Stockton	Dumped outside city	.....	.....	.....	.....	2½ mi.	.....
Colorado:							
Denver	Fed to hogs	.....	.....	.....	.....	7-10 mi.	Yes
Ft. Collins	Fed to stock	.....	.....	.....	.....	5 mi.	Yes
Greeley	Fed to hogs	.....	.....	.....	.....	.....	Fairly
Montrose	Fed to hogs	.....	.....	.....	.....	.....	.....
Salida	Dump	.....	.....	.....	.....	.....	.....
Connecticut:							
Bridgeport	Municipal reduction plant	71,790	.....	.....	.....	In city	.....
Bristol	Fed to pigs and burying	.....	.....	.....	.....	2 mi.	.....
Hartford	Fed to pigs and burying	24,293*	.....	.....	.....	1-5 mi.	Yes
Manchester	Dumped	.....	.....	.....	.....	.....	.....
Middletown	Dumps	No	.....	.....	.....	1 mi.	Yes
New Britain	Fed to swine	.....	.....	.....	.....	.....	.....
New Haven	Fed to pigs	40,000	.....	.....	.....	5 mi.	Yes
New London	Fed to swine	8,000	.....	.....	.....	3 mi.	Sale of swine covers cost
Norwalk	Dumped & covered	.....	None	.....	.....	.....	.....
Stratford	Burned, buried, fed to pigs	.....	.....	.....	.....	.....	No
Willimantic	Piggery	2,500	.....	.....	.....	2 mi.	Yes
District of Columbia:							
Washington	Reduction	175,000	Modified Chamberlain 350 ton	.....	$100,000	35 mi.	Yes
Florida:							
Clearwater	Dump and burned	$7,200	.....	.....	.....	.....	Yes
Fort Myers	Incinerator	.....	.....	.....	.....	.....	.....
Gainesville	Incinerator and fed to hogs	.....	.....	.....	.....	.....	.....
Jacksonville	2 incinerators	.....	.....	.....	.....	.....	.....
Sanford	Incineration	400	Nye—20-ton	.....	New	1 mi.	Yes
St. Petersburg	Burned	3,000	1 10-ton Nye & 1 15-ton Bayless	Unknown	$1,000	1 mi.	Yes—Expect to install garbage disposal plant in near future
Georgia:							
Albany	Crematory	240	.....	10,000	100	1 mi.	Yes
Griffin	Fertilizer and incinerated	.....	.....	.....	.....	.....	Yes
La Grange	Incinerated	600	"Nye Odorless"—12-ton	5,000	50	½ mi.	Yes
Rome	Open dump	.....	.....	.....	.....	.....	No

*Including collection.

Idaho:							
Boise City	Fed to hogs	.....	.....	.....	.....	.....	.....
Caldwell	Dump	.....	.....	.....	.....	.....	No
Twin Falls	Dump grounds	None	None	.....	.....	1 mi.	No—Expect to install garbage disposal plant in near future
Pocatello	Dump	.....	.....	.....	.....	2 mi.	Yes
Illinois:							
Blue Island	Clay hole	.....	.....	.....	.....	2 mi.	Yes
Champaign	Burying and fed to hogs	.....	.....	.....	.....	.....	Fairly
Chester	Dumps or lots	.....	.....	.....	.....	.....	.....
Chicago	Reduction	454,000	No Std. make; cap. 500 ton	2,000,000	40,000	Center	No
Chicago Heights	Incineration	.....	McGuire 6-ton cap.	.....	.....	1 mi.	Yes
East Moline	Fed to hogs, dumps	.....	.....	.....	.....	Outside	No
Evanston	Incineration	.....	.....	.....	.....	2½ mi.	Yes
Galesburg	Incineration	14,000	E. M. Jones, St. Louis	.....	.....	1¼ mi.	.....
Glencoe	Fed to hogs and buried	.....	.....	.....	.....	1½ mi.	Yes
Joliet	Burned	.....	.....	.....	.....	.....	.....
Kewanee	Dumped in Sylvan Glen	1,576	.....	.....	.....	2 mi.	Yes
Lincoln	City dump & burned	$600	None	.....	.....	3 mi.	Yes
Marion	Dumped on city land	.....	.....	.....	.....	Out of City	No
Murphysboro	Buried	3,000	.....	.....	.....	.....	Yes
Oak Park	Incineration	12,000	Lewis & Kitchen—50-ton	11,858	3,500	Center	Yes
Quincy	Fed to hogs, dumped	.....	.....	.....	.....	.....	No
Indiana:							
Columbus	Public dump	5,000	.....	.....	.....	1 mi.	Yes
Elwood	Dump, fill	.....	.....	.....	.....	Edge of City	Fairly
Lafayette	Burned	7,762	.....	.....	.....	.....	.....
Lebanon	Hauled to country	.....	.....	.....	.....	.....	.....
Mishawaka	Buried	.....	.....	.....	.....	.....	.....
Peru	Given to farmers	.....	.....	.....	.....	.....	.....
Portland	Fed to stock	$500	None	.....	.....	2 mi.	Yes
Richmond	Hog feed and incineration	Plant new	Smith 18—30-ton	.....	.....	¼ mi.	Yes
Shelbyville	Fed to hogs	1,500	.....	.....	.....	.....	.....
South Bend	Fed to hogs	.....	.....	.....	.....	.....	.....
Terre Haute	Fed to hogs	.15 per capita	.....	.....	.....	.....	.....
Valparaiso	Dump	$2,500	.....	.....	500	1½ mi.	.....
Wabash	Fed to hogs	.....	.....	.....	.....	.....	.....
West Lafayette	Fed to hogs	.....	.....	.....	.....	2 mi.	Quite
Iowa:							
Ames	Fed to hogs	.....	.....	.....	.....	.....	Fairly
Cedar Rapids	Dumped in open	1,900	.....	.....	.....	2 mi.	No—Expect to install garbage plant in near future
Charles City	Fed to hogs	.....	.....	.....	.....	.....	.....
Cresco	Buried	.....	.....	.....	.....	.....	Yes
Creston	Fed to hogs	.....	.....	.....	.....	.....	Quite
Davenport	Fill low land	.....	.....	.....	.....	.....	.....
Dubuque	Reduction plant	.....	.....	.....	.....	.....	No
Eagle Grove	Dump ground	.....	.....	.....	.....	.....	.....
Keokuk	Buried	.....	.....	.....	.....	1 mi.	.....
Marshall	Dump	.....	.....	.....	.....	2 mi.	No
Mason City	Incineration	$2,833	Jones	$14,000	$10	1¼ mi.	Yes
Muscatine	Fed to hogs	.....	.....	.....	.....	.....	.....
Ottumwa	Burned	1,600	Jones 24-ton per day	$18,000	$100	1 mi.	Yes
Kansas:							
El Dorado	Fed to hogs	.....	.....	.....	.....	.....	.....
Independence City	Fed to hogs	.....	.....	.....	.....	.....	Yes
Salina	Low dumps	.....	.....	.....	.....	.....	.....
Kentucky:							
Ashland	Incineration	100	.....	.....	.....	.....	.....
Ft. Thomas	Fed to hogs	3,000 (G&R)	.....	.....	.....	1 mi.	No
Madisonville	Taken to farms	.....	.....	.....	.....	.....	.....
Paducah	Fed to hogs	.....	.....	.....	.....	.....	No
Winchester	Burned	.....	.....	.....	.....	.....	.....
Louisiana:							
New Orleans	Dumped in swamp and burned	.....	.....	.....	.....	.....	.....

GARBAGE DISPOSAL—(Continued)

City	Method of Disposal	Cost of Operation, Per Year	Make and Capacity of Plant	Cost of Plant	Annual Maintenance and Repairs	Distance from Center of City	Is It Satisfactory Remarks
Maine:							
Augusta	Fed to pigs	.....	.....	.....	.....	.....	Yes
Oldtown	City dump	$350	.....	.....	.....	½ mi.	.....
Massachusetts:							
Adams	Town farm	.....	.....	.....	.....	1 mi.	Yes
Beverly	Fed to pigs	.....	.....	.....	.....	.....	Yes
Brockton	Fed to pigs	.....	.....	.....	.....	.....	Yes
Fall River	Fed to pigs	.....	.....	.....	.....	.....	Yes
Fitchburg	Fed to pigs and plowed in land	.....	.....	.....	.....	.....	Yes
Haverhill	Out of city	.....	.....	.....	.....	.....	.....
Holyoke	Collectors use or sell	.....	.....	.....	.....	.....	.....
Lynn	Sold by annual contract	.....	.....	.....	.....	.....	.....
Medford	Sold to farmers	.....	.....	.....	.....	8 mi.	.....
Middleboro	Feeding hogs	.....	.....	.....	.....	.....	.....
New Bedford	Reduction plant	$90,000	Cobwell 50-ton per day	.....	.....	3 mi.	Yes
Newton	Sold by contractor	31,300	.....	.....	.....	.....	Fairly
No. Adams	Fed to hogs	.....	.....	.....	.....	.....	.....
Peabody	Fed to swine	.....	.....	.....	.....	.....	.....
Rockland	Dump	.....	.....	.....	.....	1 mi.	.....
Watertown	Contractor disposes of it	.....	.....	.....	.....	.....	Yes
Winchester	Sold to contractor	7,500	.....	.....	.....	⅓ mi.	Yes
Worcester	Fed to swine	.....	.....	.....	.....	.....	Yes
Michigan:							
Alma	Fed to hogs	.....	.....	.....	.....	1.5 mi.	Yes
Ann Arbor	Fed to hogs	.....	.....	.....	.....	.....	.....
Detroit	Reduction plant	.....	.....	.....	.....	Out of city	.....
Flint	Fed to hogs	Gr. profit, $14,290	.....	.....	.....	12 mi.	Yes
Highland Park	Reduction	.....	.....	.....	.....	.....	.....
Ishpeming	Burned	.....	Hunter McGuire Incinerator	.....	.....	½ mi.	Yes
Jackson	Buried	.....	.....	.....	.....	2 mi.	No
Lansing	Fed to hogs	.....	.....	.....	.....	4 mi.	Yes
Ludington	Burned	$1,200	.....	.....	.....	1½ mi.	Yes
Monroe	Burned in swamp	.....	.....	.....	.....	.....	.....
Muskegon	Dump	19,000	.....	.....	.....	.....	.....
Niles	Fed to hogs	.....	.....	.....	.....	.....	.....
Pontiac	Hog farm	Self-support	.....	.....	.....	5 mi.	Yes
Port Huron	Fed to pigs and chickens	.....	.....	.....	.....	.....	Very
Sault Ste. Marie	City dump, hog feed	.....	.....	.....	.....	.....	No
Sturgis	Fed to hogs	.....	.....	.....	.....	.....	.....
Minnesota:							
Austin	Buried	17.20	.....	.....	.....	2 mi.	Yes
Brainerd	Municipal dump and fed to hogs	.....	.....	.....	.....	.....	.....
Ely	City dump	.....	.....	.....	.....	2 mi.	Yes
Fairmont	Fed to hogs, burned	.....	.....	.....	.....	.....	.....
Minneapolis	Incineration	.....	.....	.....	.....	.....	.....
Pipestone	Fed to hogs	.....	.....	.....	.....	.....	.....
Rochester	Hog farm	6,000	.....	.....	.....	3 mi.	Yes
St. Paul	Fed to hogs	Ap. 60,000	.....	.....	.....	.....	.....
Willmar	City dump	.....	.....	.....	.....	.....	.....
Mississippi:							
Natchez	Dumped in river	.....	.....	.....	.....	.....	.....
Missouri:							
Columbia	City dump	.....	.....	.....	.....	About 1½ mi.	No
Joplin	Fed to hogs	.....	.....	.....	.....	.....	.....
Kansas City	Hog feeding	.....	.....	.....	.....	.....	Expect to install garbage plant in near future
Sedalia	Incinerated	.....	24-ton Nye Odorless	$16,000	None	¾ mi.	Yes
Springfield	Hog feeding	None	None	.....	.....	.....	No
Montana:							
Havre	Fed to hogs, city dump	.....	.....	.....	.....	1 mi.	Yes
Kalispell	Burned	1,500	.....	.....	.....	2 mi.	Yes
Nebraska:							

Nebraska:							
Fremont	Fed to hogs, city dump	.....	.....	.....	.....	.....	Very
Hastings	Buried	700	.....	.....	.....	1½ mi.	Yes
Lincoln	Fed to hogs, city dump	.....	.....	.....	.....	.....	.....
Omaha	Fed to hogs, city dump	.....	.....	.....	.....	.....	.....
Nevada:							
Winnemucca	City dump	.....	.....	.....	.....	Out City Limits	.....
New Hampshire:							
Franklin	Dumped	2,000	.....	.....	.....	2 mi.	No
Keene	Incinerated, hog feed	2,000	.....	.....	.....	.....	Yes
Nashua	Fed to pigs	.....	.....	.....	.....	.....	.....
New Jersey:							
Asbury Park	Fed to hogs	.....	.....	.....	.....	2 mi.	No
Atlantic City	Incinerated	.....	Owned by contractors	.....	.....	15 mi.	Yes
Bergenfield	Public dump	.....	.....	.....	.....	.....	Yes
Freehold	Fed to hogs	.....	.....	.....	.....	3 mi.	Fairly
Garfield	Fill low land	.....	.....	.....	.....	.....	.....
Hackensack	Fill meadows	.....	.....	.....	.....	½ mi.	Yes
Irvington	Dumped on low land	.....	.....	.....	.....	.....	Very
Long Branch	Dumped, fed to swine	.....	.....	.....	.....	Outlying Dist.	.....
Millville	Fed to pigs and chickens	.....	.....	.....	.....	.....	Very poor
Montclair	Hog feeding	Rec'd $1 per load	.....	.....	.....	5 mi.	.....
Newark	Fed to hogs	Privately owned	.....	.....	.....	2.5 mi.	.....
New Brunswick	Fed to hogs; incinerated	.....	.....	.....	.....	.....	.....
Newton	Back of lots	.....	.....	.....	.....	.....	No
Orange	Taken care of by contractors	.....	.....	.....	.....	.....	.....
Paterson	Burned in incinerator	$15,305	Heenan destructor	.....	$3,031	1 mi.	.....
Phillipsburg	Plowed under ground	.....	.....	.....	.....	2 mi.	.....
Rahway	Dumped on lowland	.....	.....	.....	.....	.....	Contemplate erect. of incin.
Roselle Park	Dump	3,000	.....	.....	.....	.....	No
Spring Lake	Fed to hogs	.....	.....	.....	.....	8 mi.	Not entirely
Summit	Fed to hogs	.....	.....	.....	.....	.....	Reasonably
Westfield	Sold to farmers	.....	.....	.....	.....	.....	No
New York:							
Albany	Fed to hogs	.....	.....	.....	.....	.....	.....
Amsterdam	Burned	8,000	Morse-Boulger Incinerator	15,000	3,000	2 mi.	Yes
Auburn	Buried outside city	.....	.....	.....	.....	.....	.....
Binghampton	Burned	$51,079	.....	.....	.....	.....	.....
Buffalo	Hog feeding	Profit made	.....	.....	.....	9 mi.	Yes
Carthage	Feeding swine; buried	.....	.....	.....	.....	.....	No
Glens Falls	Fed to swine; dumped	.....	.....	.....	.....	.....	No
Gloversville	Dumped	.....	.....	.....	.....	Outside city	.....
Hempstead	Buried	8,000	.....	.....	.....	2 mi	Yes
Herkimer	Bank of river	.....	.....	.....	.....	Near city limits	Yes
Hornell	Fed to hogs; buried	.....	.....	.....	.....	.....	.....
Hudson	Fed to hogs; buried	2,200	.....	.....	.....	.....	Very
Kingston	Plowed in ground out of city	9,000	.....	.....	.....	.....	.....
Little Falls	Fed to pigs	.....	.....	.....	.....	.....	.....
Mineola	Dump	.....	.....	.....	.....	Outside village	No; nuisance
N. Y.: Manhattan, Bklyn & Bronx Boros.	Dumped at sea	23c per ton	.....	.....	.....	15-20 mi.	No; expensive and pollutes shores
Niagara Falls	Dumped into rapids	.....	.....	.....	.....	.....	Yes
Oneida	Dump	.....	.....	.....	.....	1 mi.	Yes
Ossining	On farmland	.....	.....	.....	.....	3 mi.	No
Oswego	Fed to hogs; dump	.....	.....	.....	.....	Dump in country	No
Poughkeepsie	Fed to hogs; buried	.....	.....	.....	.....	.....	.....
Schenectady	Reduction plant	17,500	Garbage Reduction Plant	160,000	.....	.....	.....
Syracuse	Reduction plant	.....	Cobwell Reduction Plant	.....	.....	.....	Very (sanitary); no (expen.)
Tarrytown	Fill	.....	.....	.....	.....	3,000 ft.	Yes
Utica	Pig farm	.....	.....	.....	.....	3 mi.	Not entirely
Watertown	Fed to pigs	.....	.....	.....	.....	.....	.....
Watervliet	Dump	.....	.....	.....	.....	.....	No
North Carolina:							
Durham	Buried	.....	2 Nye Odorless Incinerators	16,000	100	½ mi.	Yes
Elizabeth City	Hauled to country	.....	.....	.....	.....	2 mi.	No
Fayetteville	Incinerated	1,200	10-ton Nye Odorless Incin.	4,000	25	1,500 ft.	Yes
Goldsboro	Dump and incinerated	.....	.....	.....	.....	.....	Crude system

GARBAGE DISPOSAL—(Continued)

City	Method of Disposal	Cost of Operation, Per Year	Make and Capacity of Plant	Cost of Plant	Annual Maintenance and Repairs	Distance from Center of City	Is It Satisfactory Remarks
Greensboro	Incinerated	$5,000	Nye Odorless Incinerator	$20,000	$150	1½ mi.	Yes
Henderson	Dumped	3,000	.....	.....	.....	.....	Opera. cost inc. ash & rub.
Wilmington	Sold to farmers	4,100	.....	.....	.....	.....	.....
North Dakota:							
Bismarck	City dump	900	.....	.....	.....	.....	Unsatis.; poss. build cre. lat.
Fargo	Dump ground	.....	.....	.....	.....	Out of city	Very (incin contemplated)
Jamestown	Potter's field	Ap. 300	.....	.....	.....	1½ mi.	Yes
Mandan	Dumped on land	.....	.....	.....	.....	1 mi	Entirely
Valley City	City dump; burned	$600	.....	.....	.....	.....	Yes
Washburn	Over bank into river	.....	.....	.....	.....	.....	No change contemplated
Ohio:							
Akron	Fed to hogs	Not known	.....	.....	.....	9 mi.	No
Ashland	Sold for feed	2,400	.....	.....	.....	.....	Yes
Ashtabula	Buried outside city	1,500; (G&R)	.....	.....	.....	.....	.....
Bellefontaine	Dump	.....	.....	.....	.....	½ mi.	Yes
Bucyrus	Fed to hogs	3,000	.....	.....	.....	2 mi.	No
Canton	Hog ranch	Nominal	.....	.....	.....	.....	Yes
Chillicothe	Dump	7,000	.....	.....	.....	2 mi.	No
Cincinnati	Reduction	.....	.....	.....	.....	.....	.....
Columbus	Reduction	Profit	.....	.....	.....	.....	Yes
Dayton	Reduced	40,000	Bastard	60,000	.....	8 mi.	Very
Delaware	Fed to pigs	.....	.....	.....	.....	.....	.....
Elyria	Fed to pigs and reduction	.....	.....	.....	.....	.....	Very
Fremont	Plowed under	.....	.....	.....	.....	.....	Yes
Lancaster	Dumped and fed to hogs	.....	.....	.....	.....	Out of city	.....
Lima	Sold to farmers	.....	.....	.....	.....	.....	No
Niles	Public dump	.....	.....	.....	.....	.....	.....
Portsmouth	Dumps	8,100	.....	.....	.....	.....	.....
Urbana	Fed to hogs	.....	.....	.....	.....	1 mi	Yes
Van Wert	Fed to hogs	.....	.....	.....	.....	.....	.....
Wilmington	Fed to hogs	None	.....	.....	.....	.....	.....
Wooster	Fed to hogs	.....	.....	.....	.....	Outside city	Yes
Youngstown	Creamatory and hog farm	.....	.....	.....	.....	8 mi.	.....
Zanesville	Burned; fed to pigs	.....	.....	.....	.....	.....	.....
Oklahoma:							
Ada	Fed to hogs	.....	.....	.....	.....	1 mi	.....
Blackwell	Burned at dump	.....	.....	.....	.....	2 mi.	No
Enid	Fed to hogs; burned	.....	.....	.....	.....	2 mi.	No
Okla. City	Fed to hogs; dump	.....	.....	.....	.....	.....	.....
Oregon:							
Astoria	Burned; fed to hogs	.....	.....	.....	.....	.....	No; odor from burning
Eugene	Fed to hogs; dump	.....	.....	.....	.....	.....	.....
Klamath Falls	Dump; burned	.....	.....	.....	.....	.....	No
La Grande	Pig feed	None	.....	.....	.....	2 mi.	No
Pendleton	Dump	.....	.....	.....	.....	1.3 mi.	.....
Pennsylvania:							
Altoona	Incinerated	4,000	Decarie 50-ton	$70,000	750	3 mi.	Yes
Beaver Falls	Incinerated	.....	Lewis & Kitchen	.....	.....	½ mi.	.....
Berwick	Dumped on river bank	.....	.....	.....	.....	.....	No
Bethlehem	Hog feeding; dumps	.....	.....	.....	.....	.....	Yes, tho dump mainten. exp.
Braddock	Dump	.....	.....	.....	.....	.....	.....
Carlisle	Fed to pigs	2,000	.....	.....	.....	2 mi.	Yes
Clairton	Incinerated	.....	.....	.....	.....	.....	Very
Coatesville	Fed to hogs; buried	.....	.....	.....	.....	.....	.....
Dormont	Fed to hogs	.....	.....	.....	.....	.....	No
Domont	Incinerated	.....	Decarie incinerator	.....	.....	.....	.....
Easton	Incinerated	12,424	35-ton Morse-Boulger	13,390	6,780	1½ mi.	Yes
Elizabethtown	Fed to hogs; dump	.....	.....	.....	.....	.....	Some complaints of dump
Ellwood	Incinerated	.....	.....	.....	.....	½ mi.	.....

Ellwood	Incinerated	.....	.....	.....	.....	½ mi.	.....
Erie	Fed to hogs	.....	.....	.....	.....	4½ mi.	.....
Franklin	Dump	960	.....	.....	.....	.....	.....
Freeland	Burned	800	.....	.....	.....	1 mi.	Yes
Greenville	Fed to pigs; dumps	.....	.....	.....	.....	2 mi.	.....
Hanover	Old stone quarries	.....	.....	.....	.....	.....	.....
Hazeltown	Ash dump, cow and hog feed	.....	.....	.....	.....	.....	.....
Kittaning	Fed to pigs	.....	.....	.....	.....	.....	.....
Lebanon	Dump	.....	.....	.....	.....	1 mi.	.....
Lewistown	Dump	.....	.....	.....	.....	.....	No
Lock Haven	Buried in pits	.....	.....	.....	.....	.....	No
Meadville	Hog feed and incineration	.....	Dixon 25-ton (1903)	8,258	300-400	incin. 1½, pig. 3	Yes
New Brighton	Taken to country	.....	.....	.....	.....	.....	.....
No. Braddock	Incinerated	Ap. 3,000	Decarie	28,000	.....	1 mi.	Yes
Parkesburg	Public dump	.....	.....	.....	.....	.....	Fairly
Pittston	Burned	12,000	.....	.....	.....	½ mi.	Yes
Rankin	Incinerated	6,049	Decarie 10-ton	10,500	.....	½ mi.	Yes
Steelton	Private property	.....	None	.....	.....	.....	.....
Summit Hill	.....	2,000	.....	.....	.....	½ mi.	Yes
Tyrone	Feed hogs; burned	.....	.....	.....	.....	.....	.....
W. Pittston	Dump	None	.....	.....	.....	1 mi.	Yes
Wilkensburg	Reduction	.....	.....	.....	.....	20 mi.	.....
Winton	Fill in low land	$250	None	.....	.....	.....	.....
Rhode Island:							
Newport	Dump	.....	.....	.....	.....	Lower part city	.....
Providence	Fed to swine	.....	.....	.....	.....	Island out of city	.....
South Carolina:							
Charleston	Burned; salt marshes	2,147 (3 mo.)	Griscom-Russell Destructor	.....	7,585	.....	.....
Spartanburg	Burned	.....	5-ton	.....	.....	½ mi.	Yes
South Dakota:							
Winner	Fed to hogs	.....	.....	.....	.....	.....	.....
Tennessee:							
Cleveland	Fed to hogs	.....	.....	.....	.....	.....	Yes
Memphis	Incineration	59,732.72	50-ton Sparks & Dixon	2,000	3,000	1 mi.	.....
Morristown	Burned	Ap. 10,000	.....	.....	.....	.....	.....
Texas:							
Amarillo	Fed to hogs; incineration	.....	.....	.....	.....	.....	.....
Beaumont	Incineration	Ap. 35,000	Nye Odorless	25,000	250	2 mi.	Yes
Dallas	Incinerated	Ap. 1.50 per ton	Stokes 3 40-ton, 1 80-ton	163,000	.....	1 mi.	Yes
Denton	Dump	.....	.....	.....	.....	Out of city	.....
Eagle Pass	Burned	Ap. 2,600 (G&R)	.....	.....	.....	2 mi.	No
Eastland	Burned	1,500	Stokes incinerator, 12-ton	15,000	100	6 mi.	Yes
Galveston	Incinerated and dump	.....	.....	.....	.....	.....	No; need more incinerators
McKinney	Fed to hogs	.....	.....	.....	.....	.....	.....
Mineral Wells	Dump	.....	.....	.....	.....	.....	No; disease germs
Navasota	City dump	.....	.....	.....	.....	.....	No
Port Arthur	Incinerated	.....	Superior 10-ton	10,000	500	1 mi.	Yes; propose to install 30-ton plant
Utah:							
Logan City	Fed to hogs	.....	.....	.....	.....	.....	.....
Ogden City	Feed at packing plant	.....	.....	.....	.....	.....	Very
Vermont:							
Barre	Fed to hogs & chicks., burn., bur'd	.....	.....	.....	.....	.....	.....
Bennington	Dump	.....	.....	.....	.....	3 mi.	No
Burlington	Fed to swine	None	.....	.....	.....	.....	Yes
Springfield	Fed to swine	.....	.....	.....	.....	.....	.....
Virginia:							
Danville	Dump on river bank	.....	.....	.....	.....	2 mi.	No
Fredericksburg	Fed to hogs; buried	.....	.....	.....	.....	.....	.....
Lynchburg	Incinerated	1,776	Decarie—25-ton	$25,000	$300	1 mi.	Yes
Newport News	Dump; fill	14,500	.....	.....	.....	1 mi.	No
Norfolk	Feeding hogs; incinerated	.....	Decarie	25,000	500	1,000 ft.	Yes—need another inciner.
Petersburg	Incinerated	.....	.....	.....	.....	.....	.....
Portsmouth	Incinerated	.....	2 50-ton plants	58,000	50	½ mi.	Yes
Richmond	Cremated	14,831	Decarie	50,000	100	1½ mi.	.....
Roanoke	Incinerated	.....					

GARBAGE DISPOSAL—(Continued)

City	Method of Disposal	Cost of Operation Per Year.	Make and Capacity of Plant	Cost of Plant	Annual Maintenance and Repairs	Distance from Center of City	Is It Satisfactory?; Remarks
Washington:							
Aberdeen	Burned on dump	.....	.....	.....	.....	Outside city	.....
Chehalis	Dump	.....	.....	.....	.....	.....	Fairly
Seattle	Fill lowlands	30c per ton	.....	.....	.....	.....	.....
Spokane	Incinerated	$4,000	Decarie 50-ton	$90,000	$1,000	1 mi.	Yes
Walla Walla	Fed to hogs	.....	.....	.....	.....	.....	Yes
West Virginia:							
Bluefield	Fed to hogs	.....	.....	.....	.....	.....	.....
Clarksburg	Burned	16,000	30-ton	13,000	1,000	2 mi.	Yes
Huntington	Incineration	20,000	Nye Odorless—70-ton	.....	.....	.....	Yes
Parkersburg	Fed to hogs	.....	.....	.....	.....	.....	Fairly
Wisconsin:							
Appleton	Fed to hogs	.....	.....	.....	.....	.....	.....
Baraboo	Dump	.....	.....	.....	.....	.....	.....
Fond du Lac	Fill park	.....	.....	.....	.....	.....	No—bad odor
Green Bay	Fed to hogs	.....	.....	.....	.....	2 mi.	Yes
Janesville	Fed to hogs	.....	.....	.....	.....	.....	.....
Kenosha	Dumped in lake	.....	.....	.....	.....	.....	Very
Lake Geneva	Gravel pit	.....	.....	.....	.....	City limit	No; fire danger and odor
Menasha	Fed to hogs	.....	.....	.....	.....	½ mi.	No
Milwaukee	Incineration	.....	Heenan & Froude	.....	.....	.....	Yes; need another
Racine	Incineration	40,000	10-ton per 18-hr. day	30,000	3,000	Center city	.....
Sheboygan	Burned	Ap. 11,000	Hunter McGuire—12-ton	10,000	.....	Near center	Yes
Shorewood	Plow under farm land	.....	.....	.....	.....	.....	.....
Wisconsin Rapids	Dump	5,700	.....	.....	.....	1 mi.	No
Wyoming:							
Cheyenne	City dump	.....	.....	.....	.....	2 mi.	No
Sheridan	City dump; feed pigs & chickens	.....	.....	.....	.....	.....	.....

STREET CLEANING—SUPPLEMENTARY DATA

City	Miles of Street Cleaned: Daily	1 to 3 Times a Week	Less Than Once a Week	Equipment Owned by City	Equipment Preferred for Use on Each Kind of Pavement: Kind of Pavement	Equipment Preferred
Alabama						
Birmingham	7	8	150	60 hand brooms, 2 motor-driven flush mch., 11 h. d. sprinkling wagons, 8 dirt wagons	.....	.....
California						
Sacramento	10	130	..	50 hand brooms, 15 hand scrapers, 2 vacuum str. cleaners, 11 can carriers, 2 comb. flush & sprink. h. d. wagons, 10 dirt wagons & carts	Bit. conc., res. dist. Stone blk., mac., bus. dist.	Vacuum cleaner—Not practical in bus. dist. owing to traffic congestion. Hand sweeping
Colorado						
Boulder	..	..	..	8 hand brooms, 2 m. d. flush mch., 2 m. d. sprink. wagons, 2 dirt wagons, 1 snow plow	.....	.....
Connecticut						
Norwalk	2	..	..	36 hand brooms, 12 h. scrapers, 2 h. d. mch. brooms, 3 h. d. sprink. wagons, 1 squeegee, 2 dirt carts, 8 snow plows	.....	Broom on all
Florida						
St. Petersburg	3	0	70	25 hand brooms, 8 hand scrapers, 6 pickup sweepers, 2 can carriers, 4 dirt wagons, 6 dirt carts, 2 rub. trucks	.....	.....

STREET CLEANING—SUPPLEMENTARY DATA—(Continued)

City	Miles of Street Cleaned: Daily	1 to 3 Times a Week	Less Than Once a Week	Equipment Owned by City	Equipment Preferred for Use on Each Kind of Pavement: Kind of Pavement	Equipment Preferred
Idaho						
Twin Falls	4	2	8	12 hand brooms, 2 hand scrapers, 1 gutter sweep. mch., 1 can carrier, 1 h. d. flush mch., 1 motor-driven flush mach., 4 h. d. sprink. wagons, 2 dirt wagons	.....	Broom preferred
Illinois						
Lincoln	2	3	..	24 hand brooms, 1 h. d. mach. broom, 1 h. d. flush mach., 1 h. d. sprink. wagon, 3 dirt wagons, 2 dirt carts, 5 snow plows	.....	.....
Indiana						
Portland	2	5	7	24 hand brooms, 6 hand scrapers, 1 h. d. flush mach., road grader & tractor	Concrete Brick	Flusher Broom
Iowa						
Cedar Rapids	5	10	55	144 hand brooms, 3 motor-driven mach. brooms, 16 can carriers, 1 mot.-dr. flush mach., 2 h. d. sprink. wagons, 1 squeegee, 7 dirt wagons, 1 snow plow	Bit., conc., br., wood, res. Bus. dist.	Flusher—sanitary and speedy White wings
Ottumwa	1	1	..	12 hand brooms, 1 h. d. flush mach., 4 dirt wagons, 1 snow plow	.....	.....
Maine						
Augusta	½	..	6	27 hand brooms, 5 hand scrapers, 2 h. d. mach. brooms, 4 h. d. sprink. wagons, 3 dirt carts, 2 snow plows	.....	.....
Massachusetts						
New Bedford	35	..	..	250 hand brooms, 175 hand scrapers, 2 h. d. mach. brooms, 2 m. d. mach. brooms, 1 pickup sweeper, 70 can carriers, 1 h. d. flush mach., 1 m. d. flush mach., 6 h. d. sprink. wagons, 1 m. d. sprink. wagon, 2 squeegees, 1 dirt wagon, 2 dirt carts, 4 snow plows	.....	.....
Missouri						
St. Joseph	10	..	..	½ gross hand brooms, 24 hand scrapers, 1 m. d. flush mach., 4 dirt wagons	.....	Flusher on all
Springfield	..	..	..	6 hand brooms, 2 hand scrapers, 1 h. d. mach. broom, 1 h. d. sprink. wagon, 4 dirt wagons, 4 dirt carts, 1 motor truck	.....	.....
New Jersey						
Orange	5	2	rest	24 hand brooms, 15 hoes, 1 Elgin mach. broom, 1 Elgin pickup sweeper, 2 h. d. sprink. wagons, 2 dirt carts	.....	Motor sweeper most efficient
New York						
Binghampton	15	3	..	13 hand brooms, 13 hand scrapers, 2 h. d. mach. brooms, 1 pickup sweeper, 6 can carriers, 1 h. d. flush mach., 1 mot-d. flush mach., 1 h. d. sprink. wagon, 2 dirt wagons, 2 snow plows	Bit., conc., mac. Brick, bus. dist.	Pickup sweeper Flusher
Ohio						
Cuyahoga Falls	..	2	..	2 hand brooms, 1 hand scraper, 2 h. d. mach. brooms, 1 can carrier, 1 h. d. flush mach., 1 h. d. sprink. wagon, 1 dirt wagon, 1 dirt cart, 5 h. d. snow plows	Bit., conc., br., mac.	Motor-driven pickup sweeper—economical
Pennsylvania						
Altoona	12	40	..	12 h. brooms, 1 h. d. mach. broom, 1 pickup sweeper, 12 can carriers, 1 m. d. flush mach., 1 h. d. sprink. wagon, 3 dirt wagons, 2 snow plows	.....	Motor-driven flush machine on all pavements
Steelton	3	..	..	15 h. brooms, 1 h. d. mach. broom, 6 can carriers, 1 h. d. sprink. wagon, 1 dirt cart, 4 hand brooms	.....	Hand broom on all—easily handled
Winton	1	..	..	4 hand brooms.	.....	Shovel preferred
Texas						
Eastland	..	3	..	1 h. d. mach. broom, 1 h. d. sprink. wagon, 1 dirt wagon	.....	.....
Port Arthur	2.6	..	4.5	3 can carriers, 1 h. d. flush mach., 1 dirt wagon	.....	Only asphalt
Virginia						
Richmond	13.7	13.3	11	120 h. brooms, 24 h. scrapers, 4 h. d. mach. brooms, 2 m. d. mach. brooms, 2 pickup sweepers, 25 can carriers, 3 m. d. flush mach., 2 h. d. sprink. wagons, 14 dirt carts	Bit., mac., res. dist. Conc. Br., stone, wood, Bus. dist.	Pickup sweeper Pickup sweeper & flusher Horse sweeper & hand broom Hand sweeping

river. When the timber had all been cut off, these basins were no longer used, and since then all kinds of refuse, including garbage, has been dumped into them. The city has men at these dumps to burn such refuse as is readily combustible and to keep the fill graded. These basins are privately owned, but the owners are glad to have them filled in this way, the land being adjacent to a manufacturing district which is extending on to the fills. Large areas are still available for future dumps and this method will probably continue to be employed for a number of years yet.

GARBAGE DISPOSAL

ELLWOOD, INDIANA

At Ellwood, Indiana garbage is buried on farm land by the trench system, the trenches being dug not over 18 inches deep and garbage placed therein not over 10 inches deep, well sprinkled with quick lime and covered up. The dirt for covering is obtained by digging another trench alongside of it. When carefully watched and properly done, this method has proved very satisfactory; but slackness and slovenly work results in exceedingly unsatisfactory conditions and swarms of flies in the hot season.

EASTON, PENNSYLVANIA

The destructor used by Easton, Pennsylvania, for burning garbage and other combustible rubbish during 1921 burned 5,827 tons, of which 932 was collected by private teams and the remainder by city teams. The city team collection cost an average of $2.08 per ton. Labor at the plant cost an average of $1.37½ per ton and the fuel cost 18 cents per ton, while the total maintenance charges averaged 58½ cents per ton. This gives a total cost for collection and incineration of $4.22 per ton. The ashes collected totaled 4,830 loads at a cost per load of $2.83, plus 70½ cents for maintenance. The furnace is a 35-ton Morse-Boulger, which was described in "MUNICIPAL JOURNAL" for December 28, 1910. It is located about one and a half miles from the center of the city.

LEBANON, PENNSYLVANIA

Lebanon, Pennsylvania, makes use of abandoned quarries for disposing of all its refuse. In winter the garbage is mixed with ashes and rubbish and causes no nuisance, but during the summer months some of the dumps have proven objectionable, in which case they have been treated with lime by the city, the collection being made entirely by private individuals.

GALVESTON, TEXAS

The collection and disposal of garbage by Galveston, Texas, was estimated to cost for the present year $57,880, of which $1,800 was for salary of the superintendent, $1,200 for labor at the dump, $5,928 for laborers at the incinerator, $44,016 for the operation of nineteen garbage wagons and four motor trucks, $500 for repairs to the garbage wagons, $1,500 for maintenance of the motor equipment and $2,000 for repairs to the incinerator. The incinerator burns the refuse up to its capacity and the balance is taken to a dumping ground on the outskirts of the city where it is burned.

MILWAUKEE, WISCONSIN

The incinerator at Milwaukee, Wisconsin, has been described by "MUNICIPAL JOURNAL" and referred to by us several times since it was constructed in 1910. This is a Heenan-Froude destructor containing four furnace units each with a rated capacity of 75 tons per 24 hours, based on a mixture of 60 per cent garbage and 40 per cent ashes and rubbish. Each furnace is connected with a 200-H.P. boiler. Garbage, ashes and rubbish are collected separately and the garbage is mixed with the rubbish and some ashes at the incinerator, the proportion of ashes and rubbish being adjusted to best effect the burning of the garbage. Clinker from the incineration is used for filling purposes along the lake shore and the steam generated is used to operate a 35-K.W. steam turbine and generator, current from which is used by the Milwaukee River Flushing Station, which pumps water from the lake for flushing the river. We are informed by Edward F. Petersin, chief clerk, that in order to keep up a uniform steam pressure in the boilers some coal is necessary in addition to the garbage and rubbish. "The present plant is satisfactory in every way, it does exactly what was expected of it; that is, the complete incineration of garbage, causing no nuisance whatever from either smoke or smell. The only objection to the plant is the high cost of operation and maintenance. The cost of collection per ton of garbage for 1921 was $5.79 and the cost of destruction per ton of garbage was $2.62, making a total of $8.41 per ton of garbage for collection and incineration. This, however, does not include any interest on the investment nor depreciation on the plant, but merely actual operation cost." The capacity of the incinerator has nearly been reached and the city is now considering the construction of another or possibly some other method of disposing of the refuse.

BROCKTON, MASSACHUSETTS

In Brockton, Massachusetts, garbage is collected by the Poor Department and fed to hogs at the City Home. During the past five years the appropriations and revenues for this work have been as follows:

1917—Appropriations....	$23,400	—Revenue from sale of Hogs....	$24,849
1918—Appropriations....	26 300	—Revenue from sale of Hogs....	26,531
1919—Appropriations....	30,200	—Revenue from sale of Hogs....	23,691
1920—Appropriations....	38 650	—Revenue from sale of Hogs....	25,519
1921—Appropriations....	37,530	—Revenue from sale of Hogs....	15,108

There are employed in this work twenty men, one truck and sixteen one-horse wagons. Collections are made daily from hotels, restaurants, hospitals and clubs, and weekly from other buildings.

CAMBRIDGE, MASSACHUSETTS

In Cambridge, Massachusetts, nothing but garbage is collected by the municipality. This is sold from a platform in the northern part of the city to hog raisers and farmers living in nearby towns. The current price early this year was 75 cents per cord foot. Revenue realized from the sale is about $15,000 a year and the expense of collection about $80,000. The city uses horse-drawn, tight, wooden carts, holding about two cubic yards.

Recent Legal Decisions

STATE HELD LIABLE TO HIGHWAY CONTRACTOR FOR DAMAGES FOR CAUSING DELAY

A state made a contract for the resurfacing of a highway, knowing that no subbase had been made, and that this was necessary before the top and bottom course could be laid. The contractor was given a certain time to complete his contract, and this was extended by agreement, but for lack of a subbase the contractor was compelled to wait until the following season to complete the work, suffering a loss from the rise in the cost of labor and materials. The New York Court of Claims holds, Beskin v. State, 195 N. Y. Supp. 951, that the state was liable for the damages sustained by the contractor due to the advanced cost of labor and material, under the rule that: "Where the failure of a contractor to complete the work by the time set is due to a default of the owner, the contractor may, without notice, complete the work and recover the additional expense made necessary by the delay." Barnum v. Williams, 115 App. Div. 694, 102 N. Y. Supp. 874, affirmed 190 N. Y. 205, 6 N. E. 386; Mansfield v. New York Central & H. R. R. Co., 102 N. Y. 205, 114 N. Y. 331."

STATUTE RELIEVING HIGHWAY CONTRACTORS BECAUSE OF WAR TIME CONDITIONS HELD UNCONSTITUTIONAL

The Indiana Supreme Court, Hays v. Board of Commissioners of Owen County, 136 N. E. 13, follows its former decision in Davis Construction Co. v. Board, 132 N. E. 629, holding that Indiana Acts 1919, c. 93, p. 475, purporting to relieve highway contractors from the obligations of their contracts because of conditions arising out of the war with Germany is unconstitutional.

COUNTY AND TOWN HELD NOT LIABLE FOR CONTRACTOR'S UNAUTHORIZED RELOCATION OF TRACKS ON PRIVATE PROPERTY

The construction, maintenance and control of highways is a governmental function. For convenience of administration counties and towns were organized, and to them were delegated certain powers and duties, well defined and limited by statute, among which are some duties in the construction, maintenance and control of highways, in discharging which they are performing a governmental duty, and their officers acting therein are the agents of the public and the state. The towns and counties are as exempt from the unauthorized or wrongful acts or contracts of their officers in this respect as is the state. The towns and counties and their respective officers can raise and expend public moneys for such purposes and in such manner only, and can obligate the town and county on such contracts only, as the statute specifically authorizes. They have no general powers to make contracts. If a contract is not within the power granted by statute to the town or county to make, the action of the town board or the board of supervisors, authorizing or assenting to it, does not confer a binding obligation on the town or the county.

Applying these principles, the New York Appellate Division holds, New Paltz H. & P. Traction Co. v. Ulster County and Town of Lloyd, 195 N. Y. Supp. 623, that where plans for a highway improvement required a traction company's tracks to be relocated within the highway limits on the northerly side thereof, and, although the county had not complied with Section 148 of the Highway Law, requiring land to be acquired, prior to advertisement for proposals, for a deviation from the existing highway, the contractor located the tracks on the property of an abutting owner, the contractor was a trespasser, but for his trespass neither the state, county, nor town was liable. The contract for the construction of the highway was made by the state commission, which retained full control of the work thereunder. The county and the town were without authority to make such a contract. The fact that under the statute towns and counties are to bear certain expenses in acquiring lands for a highway does not put upon them implied liability for contracts made without authority of the statute.

NECESSARY IMPROVEMENT OF HIGHWAY NOT SUBJECT TO INJUNCTION BECAUSE OF DAMAGE TO PRIVATE OWNER

The Minnesota Supreme Court holds, Dynes v. Town of Kilkenny, 189 N. W. 439, that a court should not enjoin a necessary improvement of a highway merely because it will cause damage to a private landowner. The recovery of the compensation guaranteed by the Constitution is the method designed to make the landowner good. Nor should a court enjoin the removal of soil which may contain seed or roots that will grow into a nuisance where recovery of damages is an adequate remedy and the expense and inconvenience of undoing the work far outweighs the damage done.

RECOVERY BY CONTRACTOR FOR PART PERFORMANCE OF UNCOMPLETED CONTRACT AND FOR EXTRA WORK

Where a road contractor has failed to complete his contract with the county in time, and subsequently abandons the work, which is taken over by the county, the Oregon Supreme Court holds, Feldschau v. Clatsop County, 208 Pac. 764, that the contractor is entitled to recover the contract rates for the work done under the contract, less any damages the county may have sustained by reason of his failure completely to perform the contract. This rule is sustained by various decisions in other jurisdictions.

Where the contract and the consideration are both entire, and no price is stipulated in the contract to be paid for anything less than complete performance, and there has been a part performance by one party to the contract which has been of benefit to and has been accepted by the

other, the rule in Oregon is that the party who has partly performed his contract is entitled to recover on quantum meruit for the part performed, less such damages as the other party may have sustained by reason of his failure to complete performance. But where the contract stipulates the rates and prices to be paid for that which has been done under the contract, then the right of such party to recover for part performance is limited to the rates and prices fixed by the contract. In the first instance the party is permitted to recover on quantum meruit for the reason that in the nature of things there can be no other measure of recovery than that of reasonable value; while in the latter case the parties are and should be bound by the rates and prices which they themselves have agreed should be paid therefor.

Where a contractor has been compelled to perform services outside of his contract, and not within the contemplation of the parties at the time the contract was entered into, if there is no provision in the contract stipulating the amount that he should be paid for such services, he is entitled to recover on quantum meruit.

Where a road contractor has only partly performed and has been excused from further performance by prevention, or by the repudiation or abandonment of the contract by the county, he may recover at the contract rates the value of the services rendered, or he has his action on the contract for damages.

COST OF SPECIAL IMPROVEMENTS AND ITS APPORTIONMENT

The Kansas Supreme Court holds, Buckwalter v. Henrion, 208 Pac. 645, following Bailey v. City of Wichita, 108 Kan. 282, 284, 194 Pac. 928, that a reasonable sum to cover items of incidental expenses necessarily incurred in constructing special improvements may lawfully be included in the cost thereof.

Where the cost of special improvements on city streets is fairly apportioned and fairly assessed against the abutting properties benefited thereby, in compliance with a statute fairly designed to render approximate justice to the property owners concerned, the Kansas court holds that there is no confiscation or other breach of constitutional law, although the assessments in some instance may aggregate more than the current market value of the properties taxed therefor.

TIME OF NOTICE TO OWNER OF ASSESSMENT FOR LOCAL IMPROVEMENT

Holding that the final notice of hearing for the confirmation of assessments and the privilege of filing objections thereto, as provided by the statute, is sufficient notice to owners of assessments for local improvements, the only notice of the preliminary proceedings having been by publication of the resolution of intention, the Wyoming Supreme Court says, Bass v. City of Casper, 208 Pac. 439, that all rules of apportionment of assessments are or should be based upon the underlying principle that the property has been benefited to the extent of the assessment, whether the apportionment is made by a rule previously fixed by the Legislature, on a purely mathematical basis, or is made by the local governing board according to the benefits conferred. An owner has no constitutional right to say as to whether an improvement resolved upon by the municipal authorities shall be made. This and other questions must in the interests of all, necessarily be largely left to the discretion of the governing board of the municipality. He is interested in the one vital question of the charge, the assessment made upon his property. In the legality of that charge is necessarily involved the legality of all that precedes it and of which it is the consequence. Adams v. City of Roanoke, 102 Va. 53, 45 S. E. 881. Hence, it would seem clear that no matter what rule of apportionment is used, if he is able to test the validity and the justness of the assessment at some stage of the proceedings, he is fully protected in his constitutional rights, without making the time when he shall have the opportunity so to protect himself of the essence. And this seems to be the view of the authorities.

COST OF REPAVING STREET INTERSECTIONS

Under the Kansas statute of 1921, Session Laws, ch. 118, providing that one third of the entire cost of repaving a street is to be borne by the city at large, and the remainder to be assessed against the benefited property, the Kansas Supreme Court holds, Weigand v. Lester, 207 Pac. 651, that the cost of paving the street intersections is not to be segregated from the total cost nor added to that part of the burden imposed by the statute on the city at large.

WAIVER OF RIGHT TO CUT OFF WATER SUPPLY FOR NON-PAYMENT OF OLD BILLS

The Court of Appeals of Maryland holds, Mayor and City Council of Baltimore v. Tickner, 118 Atl. 136, that where the city, after a consumer's bills for water had gone unpaid for three years, owing to his protests that the rates were too high, made a new contract to supply the consumer at a lower rate, and received the charges thereunder, it waived its right to cut off the water supply for the non-payment of the bills for the three previous years, and was confined, in the collection of these charges, to such other remedies as it had under the law.

CONSTRUCTION OF AGREEMENT AS TO PATH UNDER RAILROAD TRACKS

By agreement between a town and a railroad company a petition by the latter for the laying out of a public path for pedestrians under the railroad tracks and the decree thereon provided that the town should assume the cost of future changes. The Massachusetts Supreme Judicial Court holds, Directors of Boston & Albany R. Co. v. Town of Brookline, 136 N. E. 747, that the town could lay out the path only in accordance with the decree, and the agreement did not bargain away or infringe upon the exercise of the town's right to discontinue the way if in the future such action should be deemed advisable.